Province of
British Columbia

Ministry of
Environment

ENVIRONMENTAL EXCISE TAXES:
OPTIONS FOR BRITISH COLUMBIA

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PREFACE

Sections One through Six of this report records part of the background research conducted by staff from the Ministry of Environment in the preparation of environmental tax policy options for consideration as part of the 1990 provincial budget. Section Seven is an addendum which summarizes the environmental tax measures implemented by the 1990 provincial budget.

ACKNOWLEDGEMENTS

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SECTION ONE

INTRODUCTION

1.1 BACKGROUND

The end of the 1980s has seen the environment become the major issue on the social agenda. Society has become increasingly alarmed about the quantity of waste products it produces, the effect these waste are having on the global and local environment, and the increasing difficulty it is having in finding a environmentally responsible manner in which to dispose of these wastes.

There has also been a major shift in opinion about the way in which governments should raise the revenues necessary for pollution control and environmental management. From an economic point of view it is the waste generator (polluter) who should bear the ultimate responsibility for his or her waste products (pollutants). As such, the revenues necessary to fund waste management and pollution control should come from the waste generators and not from government. To do otherwise would mean that the general public would be subsidizing the waste disposal costs of waste producers. Under these circumstances, the waste producers would have no incentive to either reduce their waste production or to find alternative waste disposal methods.

This view, that it is polluters and not government who should fund waste management, was formalized as the "polluter-pays principle" and adopted by all member nations of the Organization for Economic Cooperation and Development (OECD), including Canada. In its guiding principles, the OECD states:

> The principle to be used for allocating costs of pollution prevention and control measures to encourage rational use of scarce environmental resources and to avoid distortions in international trade and investment is the so-called "Polluter-Pays Principle". The principle means that the polluter should bear the expenses of carrying the above mentioned measures decided by public authorities to ensure that the environment is

> in an acceptable state. In other words, the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption. (OECD, 1975).

In response to the polluter pays principle, governments are now turning increasingly to the use of economic instruments as a means of pollution control and revenue generation. Included in the list of potential economic instruments are waste discharge fees, transferable (or marketable) discharge permits, deposit systems, and environmental excise taxes (also know as product charges). The potential application of the latter economic instrument, environmental excise taxes, to British Columbia's environmental management problems is the focus of this paper.

1.2 PURPOSE AND OUTLINE OF THE REPORT

The purpose of this report is twofold. First, it reviews the use of excise taxes as a tool for use in the field of environmental management. Second, it attempts to identify specific environmental problems in British Columbia to which excise taxes could potentially be applied.

Excise taxes are levies imposed on specific commodities, services, or groups of closely related commodities or services (Due and Friedlander, 1977). Traditionally, excise taxes have been levies imposed at set rates for specified physical measurements of the goods taxed; ie. volume, weight, dimension or number of units. For example, $3 per tonne, $1.50 per barrel or $0.50 each. However, some excise taxes are now imposed ad valorem, ie. as a percentage of the good's value, although this tends to be the exception to the rule.

The remainder of this introductory section describes the potential objectives of excise taxes, discusses their use as an environmental management tool, and reviews critical administrative design criteria which should be considered when implementing a tax. Section Two reviews examples of excise taxes used throughout the world to solve post-consumer waste disposal problems. Section Three provides examples of excise taxes used to solve industrial waste disposal problems. The use of mandatory deposit systems as an alternative to excise taxes is examined in Section Four. In Section Five the results of a survey of problem products in the municipal waste stream are presented in order to provide a list of potential products upon which an environmental excise tax may be warranted. Current industrial waste problems to which an excise tax could be employed as part of a management strategy are reviewed in Section Six.

1.3 EXCISE TAX OBJECTIVES

Governments have imposed excise taxes for environmental purposes to achieve one or more of five general objectives; to achieve economic efficiency in the production and consumption of a good, to reduce the demand for a good, to serve in lieu of a user charge for the provision of a service, to generate government revenue, or to fund compensation of pollution damages.

Economic Efficiency

When the production or consumption of a good imposes a cost on some unrelated party, a negative externality is said to exist. The classic example of a negative externality is pollution. For example, a manufacturer in the production of a good may emit large quantities of air pollutants. If the costs to society resulting from the air emissions are not borne by the polluting firm, then these costs are said to be external to the firm (thus, an externality) and these costs will not be included in the firm's production decisions. Examples of the external costs imposed by polluters include injury to human health, damages to crops and forests, damage to buildings and structures, depressed property values, and lost environmental amenities.

The effect of a negative externality on resource allocation can be seen using a simplified economic model of a competitive market[1] for a hypothetical good. Figure 1-1 shows a model of a market where no negative externalities exist. The supply curve S shows the quantity of the good that producers would be willing and able to produce for any given price while the demand curve D shows the quantity of the good consumers would be willing and able to purchase at any given price. The intersection of the two curves is the point of market equilibrium where the quantity demanded is exactly equal to the quantity supplied. At this point price P* and quantity Q* are said to be the market clearing price and quantity.

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[1] The basic assumptions of perfect competition are:

a. both consumers and producers are price takers.
b. the product of all producers are identical (homogeneous products).
c. all resources are free to move in and out of the market.
d. both producers and consumers have perfect knowledge of market prices and costs.

In Figure 1-2, a negative externality is introduced into our simplified model. The negative externality causes a divergence between the private costs of production faced by the firm and the total social costs borne by society. In Figure 1-2, the curve S_p represents the supply curve for the good where only the private costs to the producing firms are included. Supply curve S_S represents the supply curve for the good where all costs, private and social (or internal and external) costs, are included. The vertical difference between the two curves represents the external cost of production (or the marginal cost of the pollution damage) to society at each level of production. If the firms do not have to bear their external costs of production, then supply curve S_p will be the relevant curve and the market will come to a equilibrium at point A with price P_1 and quantity Q_1. However, if the firms were made to bear the full costs of their production, supply curve S_s would be the relevant curve and a market equilibrium would be reached at point B with price P_2 and quantity Q_2. From society's point of view, equilibrium point A is economically inefficient as not all costs associated with the production of the good are included in the production and consumption decisions. Too much of the good is being produced at too low a price. Instead point B is the optimum level of production as all costs, both private and social, are included.

To correct this market inefficiency, society must have a means of making polluters internalize their external pollution costs. This could be done by charging firms for their waste discharges through a system of waste discharge fees set equal to the polluter's marginal external cost of production. Alternatively, an excise tax could be used. The excise tax would

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See, for example Ferguson and Gould (1975) for a more complete discussion of the concept of perfect competition.

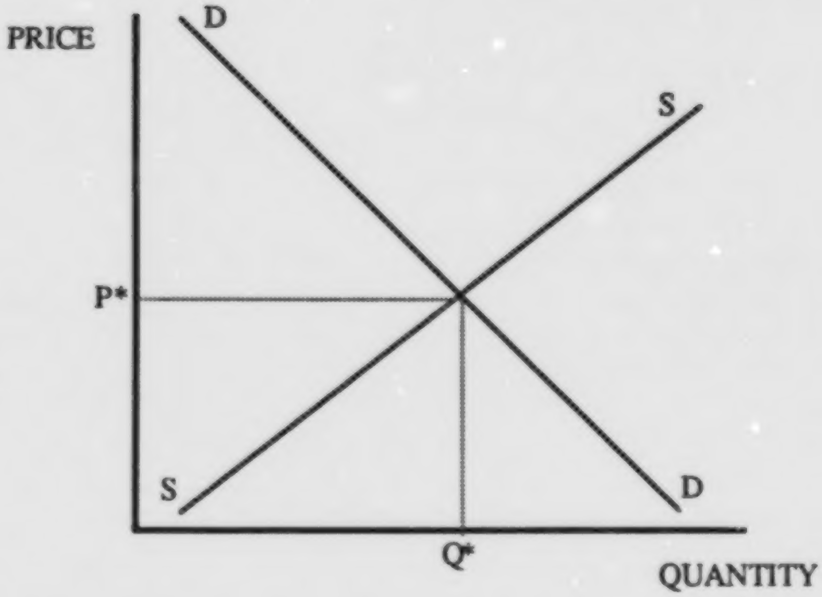

Figure 1-1

A Hypothetical Market

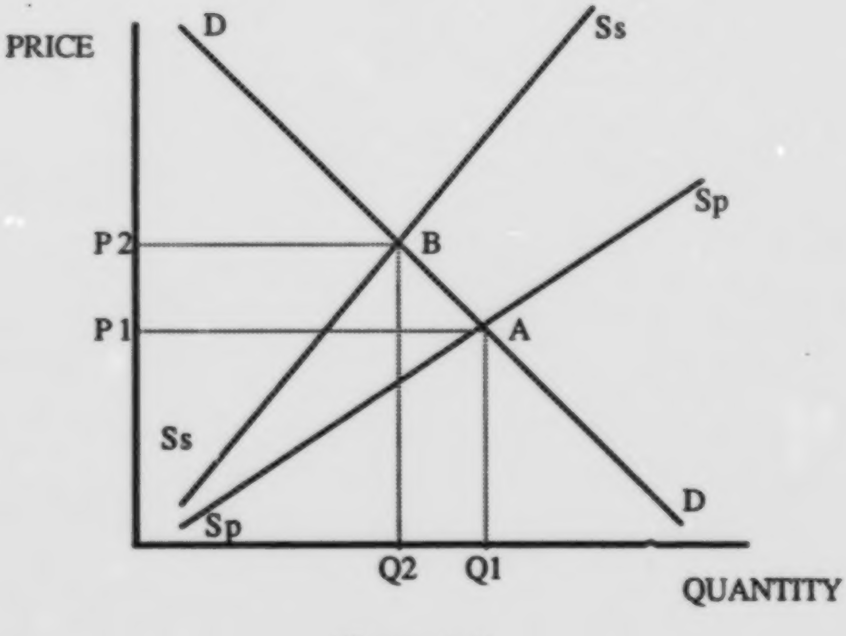

Figure 1-2

Divergence Between Private and Social Costs be set equal to the marginal external cost of production and added to the firm's cost of production. The effect of the tax would be to cause an upward shift in the firm's private supply curve from S_p to S_s thus returning the market to its economically efficient level of output. In this way, the market would be returned to the optimum level of production and economic efficiency would be restored.

In order for the excise tax to be set at the correct level to return the market to its optimum level of output, requires that government have an estimate of the marginal external cost of production. Rarely do governments have this information as external costs are very difficult to measure. In most cases, the excise taxes has been set rather arbitrarily or have been set based on other considerations. The degree to which an excise tax can be used to correct the effects of a negative externality and improve economic efficiency will be based on how closely the tax rate chosen relates to the difference between the private and social cost curves. Indeed, if the tax rate is set too high so that the private supply curve is shifted well above the social cost curve then it is possible that the economic efficiency of the market could be made worse than was the pre-tax case.

Demand Reduction

Governments have in some cases implemented excise taxes in order to substantially reduce or eliminate the demand for specific goods in cases where an outright ban of the product is not justified. Their success in achieving this goal will be determined by how responsive the demand for the good is to price increases and by the level of the excise tax relative to the price of the good. Figure 1-3 presents three hypothetical demand curves for a good on which an excise tax has been imposed. The steepness of the curves show how responsive the quantity demanded is to price increase; relatively steep curves are quite unresponsive to price changes while relatively flat curves are highly responsive. Using Figure 1-3 as an example, if an excise tax of rate T was placed on the good the price of the good would rise to P+T. The effect of this price increase would cause only a modest reduction in the demand for the good for demand curve D_1, from Q^* to Q_1. For demand curve D_2 the reduction would be greater, to Q_2, and a substantial reduction to Q_3 would occur for demand curve D_3. Thus, the more responsive the demand for a good is to price increases the more effective an excise tax will be in reducing the demand for a good.

The responsiveness of the quantity of a good demanded to changes in the goods price, referred to by economists as the good's price elasticity of demand, is usually related to the following factors (Hirshleifer, 1980, p. 147):

- Closeness of Substitutes: The more numerous and closer the substitutes for a specific good the greater will be its responsiveness to price changes.

- Luxuries vs. Necessities: A "necessity" is a good which is considered a basic requirement of human live. Consumers purchase necessities at approximately the same level at low incomes as at high incomes. A "luxury" good is one who's consumption increases as income increases. It is contended that the responsiveness to price changes will be greater for luxuries than for necessities.

In Lieu of User Charges

Excise taxes have frequently been implemented to serve in lieu of a user fee for the provision of a government service. The best example of this type of levy are the motor fuel and vehicle licensing taxes imposed by most jurisdictions in order to pay for the construction, operation and maintenance of highway systems. British Columbia, for example, first introduced a tax on gasoline of 3 cents per gallon in 1924, to fund the extension of the provincial road system (British Columbia, 1981). Another example of a tax used in lieu of a user charge are the taxes on air passengers tickets and freight which are used to fund the operation of airports. Canada imposes a tax on air passenger fights of 10 percent of the ticket price plus $4 to a maximum of $50.[2] Proceeds from the tax are used by the Department of Transport to fund the provision of air transport facilities and services (Canada, 1987b, p. 61). Excise taxes are typically used in lieu of user charges when the collection of the user charge would

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[2] The air transportation tax is implemented by Part II of the *Excise Tax Act*, R.S.C. 1985, E-13.

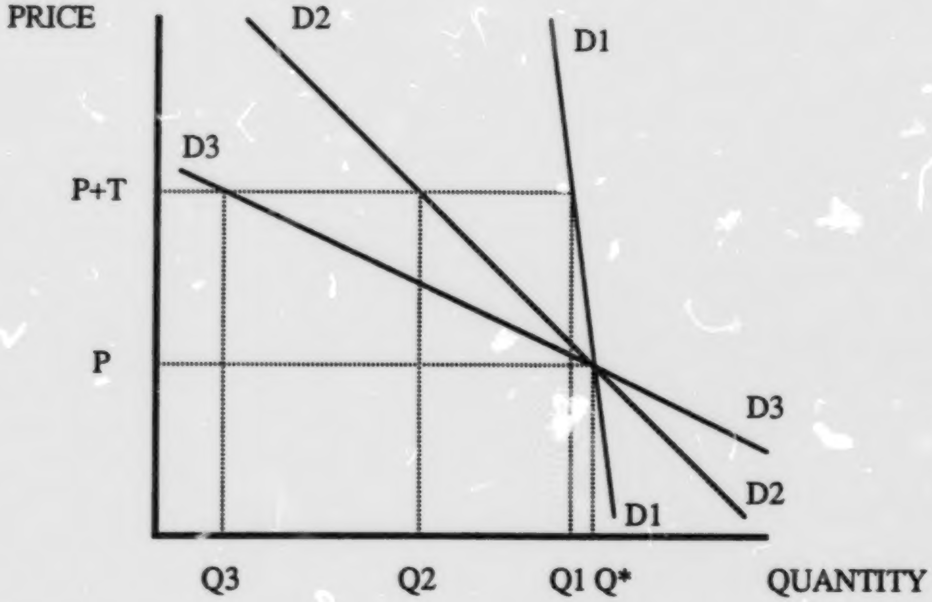

Figure 1-3
Changes in the Quantity Demanded Resulting
From an Excise Tax

be difficult or expensive.

The use of an excise tax in lieu of a user charge works best where the payment of the tax closely relates to the use of the service and where people who do not use the service are excluded from payment of the tax. For example, the payment of the motor fuel tax by an individual would vary proportionately with the distance travelled by that person, through fuel consumption, and operators of heavier vehicles, which typically cause more damage to road surfaces, would also typically consume more fuel per kilometre. In addition, the major off-road users of motor fuel, for example the agricultural sector, are excluded from the payment of the tax or pay a lower rate of tax than on-road users.

Revenue Generation

Many jurisdictions have turned to excise taxes solely as a means of revenue generation. In some cases these taxes were levied on luxury goods as a person's demand for these goods could be interpreted as a measure of a person's ability to pay an additional tax. As peoples' income rise they typically purchased more of these so-called luxury goods, which are those goods not deemed to be essential to a person's basic living standards, and thus, they could afford to pay the additional taxes. Under these circumstances the use of excise taxes could be viewed as being progressive as they would increase with a person's income and the tax would avoid the regressive nature of a general sales tax.

Compensation Funding

Some jurisdictions concerned about the potential health and physical damages which can be caused by pollution have turned to excise taxes as a mechanism to generate revenue for environmental damage compensation funds. The taxes could in this case be viewed as a type of environmental insurance premium.

1.4 PRACTICAL DESIGN CRITERIA

In addition to the environmental objectives listed above, an evaluation of environmental excise taxes has to consider the conceptual and practical considerations associated with the evaluation of any new taxes. In general, provincial taxes are evaluated on the basis of four criteria:

- **Efficiency** - the extent to which the tax distorts production and consumption patterns.

  In the case of an environmental excise tax, a primary objective may be to correct a distortion already in existence. For example, if the true cost of disposing of a product is not included in the purchase price, then a tax can be used to increase the product's price. The tax is then a way of providing a level playing field, by increasing the price of an environmentally damaging product so that less damaging substitute products become relatively cheaper.

- **Fairness** - the distributional impact of the tax on individuals in different income groups.

  Because environmental excise taxes are often introduced at a flat rate rather than at an ad valorem rate, the impact on different income groups should be evaluated. For example, a tire tax imposed at $5 per tire will be applied to an expensive tire and a cheap tire equally, yet the tax on cheap tire will equal a larger percentage of the purchase price than the tax on the expensive tire. For the environment, however, the difference in the price of the two tires does not change the fact that they will both pose the same disposal problem after their use. The question of who pays the tax and how they will be affected should be evaluated prior to the tax's introduction.

  The above comments address whether the proposed tax is equitable on the basis of income distribution. Other questions regarding equity issues are raised by the following points, which should also be taken into consideration when evaluating a new environmental tax:

- whether the proposed tax is aimed at the appropriate group;
- whether the entire group should be subject to the tax;
- whether equal polluters in equal circumstances are being treated equally;
- whether the relative treatment of polluters in different circumstances is acceptable; and
- whether the tax would impose an onerous burden on any individual or group.

- **Administration** - the cost to government of administering the tax and the burden imposed on business to comply with it.

  The cost of collecting the tax, incurred by government and business, increases as both the number of different flat rate taxes and the number of collection points increase. In circumstances where the cost of collecting an environmental tax exceeds the revenue raised, alternative means of reaching the environmental objective should be investigated.

- **Constitutionality** - for the province, a further constraint is imposed by the provincial government's limited taxation powers.

  Constitutionally, the province has the power, in most circumstances, to impose direct taxes only. According to the constitutional interpretation (which differs from an economic interpretation), a direct tax is one which is paid by the person who is intended to pay it; in other words, the tax is not passed on, in an identifiable form, to another person. The province does not therefore have the power to impose environmental taxes on products purchased by industry for the purposes of resale.

  For example, in order to avoid placing an administrative burden on retailers, some U.S. states have introduced environmental taxes on consumer products at the manufacturer or wholesale level. In the Canadian context, it would be unconstitutional for a province to impose indirect taxes such as these.

In addition to the above criteria, any environmental tax under consideration should be evaluated according to the province's overall regulatory context. Any environmental tax should be sensitive to and complement the environmental regulations already in effect.

SECTION TWO

EXAMPLES OF CONSUMER LEVEL EXCISE TAXES

2.1 INTRODUCTION

This section reviews the use of excise taxes directed at the problems associated with post-consumer waste disposal. This does not mean that the taxes are necessarily collected at the retail level. The taxes could, instead, be collected at either the wholesale or manufacturing level. In any event these taxes would, in whole or in part, be passed on to the consumer and incorporated into the final price of the good. The important distinction here is that the taxes have been imposed to take account of environmental problems resulting from consumer and not industrial waste products.

2.2 LEADED GASOLINE TAXES

Lead, in the form of tetraethyl lead, has been widely used as an additive in gasoline and other fuels to control engine "knock" and to lubricate engine exhaust valves and seats. Knock is the premature ignition of fuel in the engine cylinders which reduces engine efficiency and may cause major mechanical damage. However, lead emissions from motor gasoline exhaust has been the largest source of lead emissions in Canada reaching a peak of 14,360 tonnes emitted in 1973 (Royal Society of Canada, 1986). Lead emissions in Canada have been reduced to less than half of the 1973 peak due to government regulations[1] and the introduction of unleaded gasoline in 1972.

The reason for government regulation of leaded gasoline concentrations was that lead, when taken into the human body, can affect the blood, the nervous system, the kidneys and the reproductive systems of both men and women. The risks from lead pollution are even greater for children as their high growth rate causes their bodies to retain more lead than do adults. Lead bio-accumulates in the fatty tissues and the body can only rid itself of the lead over long periods of time.[2]

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[1] The concentration of lead in gasoline in Canada was limited to 0.77 grams per litre on January 1, 1976 by the *Leaded Gasoline Regulations*, C.R.C., Vol IV, c. 409, p. 2893. Amendments to the *Regulation* further reduced the allowable concentration to 0.29 grams per litre on January 1, 1987.

Another difficulty associated with leaded gasoline is the problem of misfueling. Misfueling is the practice of using leaded gasoline in vehicles designed to use unleaded gasoline only. These vehicles are usually equipped with a catalytic converter as a pollution control device to reduce auto emissions. If leaded gasoline is used in these vehicles the catalyst becomes "poisoned" or deactivated by the lead emissions which coats the catalyst rendering it inoperable. If prolonged misfueling occurs individual vehicle emissions can increase significantly, by up to 800% (Lower Mainland Oxidants Steering Committee, 1987).

Because of concerns about lead emissions from leaded gasoline consumption, governments have responded by imposing tighter restrictions on the concentration of lead in gasoline, by banning its production and use, and by imposing taxes to reduce the demand for leaded gasoline in favour of unleaded gasoline. For example, the Government of Canada is eliminating the production of leaded gasoline on December 1, 1990, with the exception of a limited distribution of a low-leaded gasoline.[3] In addition both the federal and most provincial governments have introduced specific tax measures to reduce the demand for leaded gasoline in Canada. Table 2-1 summarises the excise tax measures taken in Canada on the use of leaded gasoline and other fuels. All of these taxes have been recently introduced and follow concerns expressed by governments about the quantity of lead currently being emitted into the environment. Each of the taxes and the reasons for their implementation are discussed below.

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[2] A more complete review of the health effects of lead can be found in Chapter VII of the Royal Society of Canada (1986).

[3] The low leaded fuel will have a maximum lead concentration of 0.026 grams per litre.

TABLE 2-1

LEADED GASOLINE TAXES

Jurisdiction	Date Introduced	Tax Rate (per litre)	Estimated Annual Revenue ($ million)
Manitoba	1985	0.9¢	-
Manitoba	1988	1.8¢	1 (1988/89)
British Columbia	1987	2¢	37 (1987/88)
Canada	1987	1/3¢	30 (1987/88)
Canada	1989	1¢	35 (1989/90)
Ontario	1988	3¢	39 (1988/89)
New Brunswick	1989	2.2¢	2 (1989/90)
Newfoundland	1989	1.5¢	-
Saskatchewan	1989	2¢	12 (1989/90)

Source: British Columbia, 1987; Canada, 1989; Ontario, 1988; Manitoba, 1985 and 1988b; New Brunswick, 1989; Newfoundland, 1989; Saskatchewan, 1989;

Manitoba

Manitoba was the first Canadian jurisdiction to introduce a special tax measure aimed at discouraging the use of leaded gasoline. In his 1985 budget speech Manitoba's Minister of Finance stated:

> Mr. Speaker, our Government is concerned that the current pricing structure of gasoline in Canada, with leaded fuel selling at a lower price than unleaded fuel, provides an incentive to use the higher-pollutant fuel. This is inappropriate and inconsistent with our desire for a cleaner environment today and in the future.

> Accordingly, we are proposing a special surcharge on leaded fuel of 0.9¢/litre which should roughly halve the price differential between leaded and unleaded gasoline. (Manitoba, 1985, p. 31-32).

The tax came into effect on April 1, 1985.

Manitoba introduced an additional tax on leaded gasoline in 1988. The Minister of Finance, in his budget speech, stated:

> One of the most significant sources of lead in the environment is exhaust emissions of vehicles using leaded gasoline. ... The special surcharge on leaded fuels will be increased by 0.9¢ per litre, effective July 1. This is intended to eliminate the oil industry's current price structure which promotes the use of higher-pollutant leaded fuel. With the surcharge, unleaded fuel should be available at or below the price of leaded fuel in Manitoba. We anticipate a 30% decline in leaded fuel sales, and a positive effect on the environment, following implementation of these measures. (Manitoba, 1988a, p. 29).

British Columbia

Misfueling was identified in the early 1980's as a serious environmental problem in British Columbia. A 1983 survey of British Columbia service stations showed that 73 percent of leaded gas pumps had been equipped with the smaller diameter gas nozzles designed for unleaded gas. The Province responded, in conjunction with the petroleum industry, by notifying all service stations of the problems caused by the switching of gas nozzles on leaded gas pumps. A follow up survey showed that the practice of nozzle switching had dropped to between 2-3 percent by 1985 (Poon, 1986). However, the practice of misfueling continued. A 1985 survey of Vancouver's newer cars found that 13 percent were still being misfueled (Environment Canada, 1986). To do this some drivers of cars designed for unleaded gasoline had removed the inlet restrictors on their gasoline tanks, used a funnel or adaptor, or slow filled their tanks.

A major reason for misfueling was the price advantage leaded gasoline had over unleaded gas; approximately 2 cents per litre. As a result the Province levied an additional tax of 2 cents per litre on leaded fuel effective April 1, 1987. The government's reasons were:

> This change is motivated by a concern for the quality of our natural environment. The use of lower-priced gasoline in a vehicle equipped with a catalytic converter - commonly called "misfueling" - quickly and permanently destroys the converter's effectiveness and dramatically increases the emission of toxic pollutants. As well, the harmful effects of atmospheric lead itself, particularly on children, have been confirmed in many studies.
>
> For these reasons, the government has decided to use the tax system to narrow or eliminate the price differential between leaded and unleaded gasoline and thereby remove the incentive to misfuel (British Columbia, 1987, p. 21).

It was estimated that the tax would raise $37 million in 1987/88, with the amount declining in the future as leaded gasoline is phased out by federal regulations.

The provincial tax increase, coupled with a federal tax measure described below, completely removed the monetary incentive for drivers to misfuel. It was estimated that these measures would result in a 6% reduction in hydrocarbon emission (Lower Mainland Oxidants Steering Committee, 1987, p. 13).

Canada

The federal government raised its excise tax on leaded gasoline by 1/3 of a cent on April 1, 1987. In his budget speech the Minister of Finance said this measure was taken:

> ... to equalize the federal sales and excise tax burden on leaded and unleaded gasoline. This action will support the efforts of my colleague, the Minister of Environment, who has announced

> a program in co-operation with the petroleum and automobile industries to eliminate lead emissions from gasoline by the end of 1992. (Canada, 1987a, p. 9).

It was estimated that the tax would generate $30 million in revenue (Canada, 1987b).

On April 28, 1989, the federal government increased the excise tax on leaded gasoline and aviation gasoline by an additional one cent per litre. This action was taken:

> ...to discourage the use of leaded fuel. This increase in tax will accelerate the decline in the use of leaded fuel, which has clearly been shown to be harmful to the environment and to human health. (Canada, 1989a, p. 57).

It is estimated that the tax would bring in revenues of $35 million in 1989 declining to $20 million in 1990.

Ontario

Ontario introduced a special levy of 3 cents per litre on leaded gasoline on April 21, 1988. The move was taken to "reinforce the Government's commitment to environmental protection..." (Ontario, 1988, p. 12). It was anticipated that the tax would raise revenues of $39 million in its first year.

New Brunswick

New Brunswick joined the growing move against leaded gasoline in 1989 stating:

> Presently, New Brunswick is the only province which encourages the use of leaded fuel by having a lower tax on this grade of gasoline. ... In keeping with our policy to protect and enhance our environment, and in response to requests from concerned New Brunswickers, effective midnight tonight, a new 2.2-cent-per-litre tax on leaded gasoline will be imposed to

> make the pump price of leaded fuel equal to, or greater than, the price of regular unleaded fuel. (New Brunswick, 1989, p. 14).

It is anticipated that the tax will generate $2 million in its first year.

Newfoundland

In 1989, Newfoundland also introduced a surtax on leaded gasoline. Their justification was:

> Consumers should not be induced to add to our environmental problems. A body of scientific research has revealed such a danger to our health from leaded gasoline that the Federal Government has moved to ban all sales of this product after December 31, 1990. In support of recent efforts by other provinces and the Federal Government to further discourage the use of leaded fuel, I am announcing today a leaded fuel surtax of 1.5 cents per litre designed to promote earlier conversion to unleaded fuel. (Newfoundland, 1989, p. 15).

Saskatchewan

Saskatchewan introduced its tax on leaded gasoline of 2 cents per litre on April 1, 1989. The purpose of the tax was:

> This measure recognizes the contribution of users of unleaded fuel to environmental protection and will reduce the use of leaded fuel before its sale terminates in December 1990. (Saskatchewan, 1989, p. 11).

The tax will generate an estimated $12 million in revenue during the 1989/90 fiscal year.

European Initiatives

In order to reduce the use of leaded gasoline several European countries have implemented a tax differential between leaded and unleaded gasoline. The tax differentials per litre of gasoline employed by seven European countries are shown in Table 2-2.

TABLE 2-2

EUROPEAN UNLEADED GASOLINE TAX DIFFERENTIALS

Country	Tax Differentiation Per Litre (cents)
Denmark	6.92
Finland	7.23
Germany	4.62
Netherlands	2.62
Norway	6.31
Sweden	3.38
Switzerland	4.46

Source: OECD, 1989.

Comments

In all cases the taxes on leaded gasoline were introduced to reduce the use of leaded fuel because of the harmful effects of lead emissions. In British Columbia the tax was particularly directed at the misfueling problem. In most cases the tax rate was set so as to equalizes the price at the pumps for leaded and unleaded gasoline. The use of the tax to combat misfueling has been particularly effective as unleaded fuel is a more than perfect substitute for leaded gasoline for vehicles designed for unleaded gasoline use.

The extra taxes on leaded gasoline have been easily implemented as part of the existing federal and provincial fuel tax systems resulting in little or no additional administrative costs. In the short term the taxes can generate substantial revenue but will terminate with the federally mandated end to the general production and sale of leaded gasoline on December 1, 1990.

2.3 TIRE TAXES

The disposal of used vehicle tires has been identified as a significant problem by several jurisdictions. Tires, when landfilled, are bulky and tend to float up through the landfill. Used tires when stockpiled on the surface collect pools of water which can serve as a breeding ground for insects. The stockpile may also present a significant fire hazard, as was demonstrated by the recent fire in Hagersville Ontario, where a stockpile of 13 million tires caught fire, resisting the efforts of both firefighters and water bombers to extinguish it. The fire which started on February 12, 1990, was finally extinguished on March 1, 1990.

The volume of scrap tires produced each year can be staggering. For example, it is estimated that in British Columbia alone 2.2 million tires are scrapped annually (H.A. Simons Ltd., 1984). Several jurisdictions faced with a serious waste tire disposal problem have turned to excise taxes as a means to fund the disposal of scrap tires. Table 2-3 provides a summary of the tire taxes currently in use in Ontario and ten U.S. states. Each of these taxes are discussed in turn below.

Ontario

Ontario introduced a tax on tires to "help fund efforts to support recycling and environmentally sound disposal" of the tires (Ontario, 1898, p. 5). The tax rate is $5.00 for each "new pneumatic tire, including each new tire included in the purchase of a vehicle" (Ontario, 1989, p. 7). The tax came into effect on June 1, 1989, under amendments to the *Retail Sales Tax Act*.[4] Exempted are tires for commercial airplanes, production machinery, farm equipment, firefighting vehicles, wheelchairs, bicycles and toys. The tax is expected to raise $40 million annually.

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[4] *An Act to amend the Retail Sales Tax Act*, S.O. 1989, c. 38.

TABLE 2-3

TIRE TAXES

Jurisdiction	Date Introduced	Tax Rate ($ per tire)	Estimated Annual Revenue ($ million)
Washington	1985	0.12%	n.a.
	1989	1.00	3.6
Minnesota	1985	1.00	2.75-3.0
Oregon	1988	1.00	1.7
Wisconsin	1988	2.00	2.9
Ontario	1989	5.00	40
Oklahoma	1989	1.00	n.a.
Florida	1989	0.50	1.0
	1990	1.00	8.5
North Carolina	1990	1%	n.a.
Maine	1990	1.00	n.a.
Rhode Island	1990	0.50	n.a.
Virginia	1990	0.50	n.a.

Washington

In 1985, Washington State introduced a tax on "new replacement vehicle tires".[5] The tax, which is collected by tire retailers, was set at 0.12 percent of the gross proceeds of tire sales within the state. However, the tax rate was changed in 1989, from an ad valorem rate to a flat rate of $1.00 per tire effective October 1, 1989. Expected revenue from the tax is $3.6 million per year. The tax has a sunset clause which terminates the tax on October 1, 1994.

Eighty eight percent of the revenue from the tax goes to the "Vehicle Tire Recycling Account" which is used to assist state and local governments with the disposal of used tires, 10% is retained by retailers to cover their administrative costs, and 2% is retained by the Department of Revenue for administering the tax.[6] Retreaded tires are exempted from the tax.

Minnesota

Minnesota, which produces approximately 4 million scrap tires annually, banned the landfill disposal of tires in 1985. However, this ban resulted in the growth of large stockpiles of discarded tires. In response the State imposed a tax on tires to pay for a program to reduce existing tire stockpiles and to establish end-use markets for scrap tires.[7] The tax is set at $4.00 per automobile and is paid by vehicle owners whenever they transfer title of the vehicle. The tax will end on December 31, 1994, unless extended by the state legislature.

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[5] R.C.W. §70.95.510.

[6] R.C.W. §70.95.520 and §70.95.530.

[7] M.R.S. §115A.908.

Oregon

Oregon introduced a tax of $1 per tire on new replacement tires on January 1, 1988.[8] The Oregon tax is also collected by tire retailers who are allowed to retain 15% of the tax collected. Exempted from the tax are tires for devices moved exclusively by human power, devices used exclusively on stationary rails or tracks, all terrain vehicles, and farm vehicles. The tax has a sunset clause which terminates the tax on June 30, 1991, unless extended by the state legislature. In 1988/89, revenue from the tax totalled $1.7 million. Funds collected by the tax are credited to the "Waste Tire Recycling Account".[9] These funds can then be used for[10]:

- cleaning up waste tire stockpiles;
- reimbursing persons for using waste tires or chips; and
- Department expenses related to waste tire management.

Wisconsin

Wisconsin implemented a $2.00 per tire tax on vehicle tires in 1988 (Resource Recycling, 1988). It is estimated that the tax will generate $2.9 million annually which will be used to fund a scrap tire recovery and stockpile clean up program.

Oklahoma

Oklahoma, with passage of the *Oklahoma Waste Tire Recycling Act*[11], imposed a tax of $1.00 on the sale of any new tire for use on an automobile or light duty truck[12] effective July 1, 1989. Funds derived from the tax go to the "Waste Tire Recycling Indemnity Fund", which is used to compensate waste tire processing facilities at the rate of $0.50 per tire processed. The tax is collected at the retail level and retailers retain 2.5 percent of the fees collected.

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[8] O.R.S. §459.509.

[9] O.R.S. §459.614.

[10] O.R.S. §459.775.

[11] *Oklahoma Waste Tire Recycling Act*, Law 1989, c. 176, §1-10.

Florida

Included in Florida's list of solid waste management problems are the 15-17 million waste tires produced annually in the state (Florida, 1989). In response, Florida passed, as part of its comprehensive *Solid Waste Management Act*, provisions which banned the landfilling of tires and imposed a tax on tires.[13] The tax on "new motor vehicle tires" came into effect on January 1, 1989, at the rate of 50 cents per tire with the rate rising to $1 per tire on January 1, 1990. As with the other tire taxes, Florida's tax is collected from the tire retailer. The sale of recapped tires are exempted from the tax. Proceeds from the tax go into the waste tire account of the "Solid Waste Management Trust Fund". The funds are to be used to provide counties with grants to construct and operate tire disposal facilities, research, and to collect tires.[14] Currently 40 percent of the funds are allocated to the clean up of tire piles at sites where the owner is financially incapable of the clean up (Florida, 1989). The tax generated revenue of approximately $1 million in 1988/89 and is forecast to generate $8.5 million in 1989/90 (Florida, 1989).

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[12] Light duty truck is defined as a truck with a laden weight of ten thousand pounds of less (Section 3 of the *Act*).

[13] *Solid Waste Management Act*, F.R.S. §403.718.

[14] F.R.S. §403.719.

North Carolina

North Carolina imposed a "scrap tire disposal fee" effective January 1, 1990.[15] The tax of 1 percent on the sale price of new motor vehicle tires is collected from tire retailers. Recapped tires are exempted from the tax, as is the lease or rental of tires. Ten percent of the proceeds of the tax are to be credited to the state's "Solid Waste Management Trust Fund". The remaining 90 percent of revenues are to be distributed to the state's counties on a per capita basis and is to be used by the counties for the disposal of scrap tires.

Rhode Island

Rhode Island[16] implemented a tax of $0.50 per tire, effective January 1, 1990, as part of a series of taxes on "hard to dispose material".[17] The tax is collected by retailers with the funds being credited to a "Hard-to-Dispose Material Account".

Maine

An "advance disposal fee" of $1.00 per tire was implemented by Maine on July 1, 1990.[18] The tax is collected by retailers and the funds are deposited in the "Maine Solid Waste Management Fund".

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[15] North Carolina Scrap Tire Disposal Act, 1989, c. 784, s. 3. Codified as N.C.R.S. §130A-309.54 to §130A-309.56.

[16] Rhode Island R.S. §44-44-3.7.

[17] The other materials taxed included lubricating oils, antifreeze, organic solvents, and vehicle registration. The taxes on these other items are discussed below.

[18] Maine R.S. 36 § 4831-4834. The Maine statute also imposed similar taxes on lead-acid batteries, white goods, and brown goods as discussed below.

Virginia

Effective January 1, 1990, Virginia imposed a tax of $0.50 per new tire sold.[19] Exempted from the tax are tires used for:

- devices moved exclusively by human power;
- farming purposes except farm trucks; and
- devices used exclusively on stationary rails or tracks.

The tax is collected by retailers who remit 95 percent of the funds collected and retain 5 percent. The funds collected go to the "Waste Tire Trust Fund".

Comments

It would appear that all of the tire taxes have been implemented in lieu of user charges for the disposal of the waste tires. Undoubtedly, it will be administratively easier to collect this tax than it would be to collect a user fee on waste tire disposal. On the other hand, California has chosen the latter option, passing legislation which allows tire retailers to collect a 25 cent disposal fee for tires left for disposal.[20]

Of the taxes imposed, only Ontario's covers the tires included in the purchase of a new vehicle. In addition, most of the US jurisdictions specifically exempt retreaded or recapped tires from the tax. Only Washington State and North Carolina have chosen to impose an ad valorem tax rather than a fixed unit rate tax, although Washington later changed its tax to a flat rate per tire.

Minnesota's vehicle registration surcharge, while administratively simpler to collect and enforce than a retail tax on tire sales, is not directly related to tire consumption. Thus, the surcharge will not be as effective a substitute for a tire disposal user charge as would a direct tax on tires.

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[19] Virginia R.S. § 58.1-640 to 644.

[20] California R.S. Government §66799.140.

A number of states also allow the retailers who collect the tax to retain a portion of the tax in recognition of the retailers cost of collecting the tax. The retailers portion varies from 2.5-15 percent of the tax. The reimbursement of vendors for the collection of retail level sales and excise taxes is quite common. For example, in British Columbia vendors receive 3 percent of the provincial sales tax collected, to a maximum of $90 per month.[21]

It is doubtful if the U.S. state tire taxes will have any significant impact on the demand for tires due to the low tax rates used. However, Ontario which has the highest tax rate, which may account for 5-10 percent of the purchase price of the tire, may potentially have a more significant impact on demand.

2.4 LUBRICATING OIL TAXES

In British Columbia, 'special wastes' are defined as "those wastes which due to their nature and quantity are potentially hazardous to human health and/or require special disposal techniques to eliminate or reduce the hazard" (British Columbia, no date). Under the *Special Waste Regulation* to the *Waste Management Act*, the definition of special wastes specifically includes waste oils as a special waste category.[22] Of the estimate 74,000 tonnes of special wastes generated annually in British Columbia, 26,000 tonnes, or 36 percent of the total, are waste oils (Reid, Crowther and Partners Ltd, 1981).[23] Thus, the effective collection and ultimate safe disposal of waste oils is a significant environmental problem for British Columbia.

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[21] *Social Services Tax Act Regulations*. B.C.Reg. 84/58, section 5.8.

[22] B.C. Reg. 63/88. See Part 1, Section 1, Interpretation.

[23] The Special Waste Regulation defines waste oils as "automotive lubricating oil, cutting oil, fuel oil, gear oil, hydraulic oil or any other refined petroleum based oil or synthetic oil where the oils are in the waste in a total concentration greater than 3% by weight and the oils through use, storage or handling have become unsuitable for their original purpose due to the presence of impurities or loss of original properties".

Of course, all of the world's industrialized economies face a similar waste oil disposal problem. Several jurisdictions have implemented extensive waste oil collection and disposal programs to tackle this problem and some have implemented taxes on the sale of lubricating oils as a means to fund their programs. Table 2-4, provides a summary of lubricating oil taxes used in Europe and the U.S.A. to pay for the collection and disposal of waste lubricating oils. West Germany was the first country to impose such a tax and its system of waste oil collection and disposal, which served as a model for the other European countries, is discussed below in detail as a case study.

West Germany

Of the 1.1 million tonnes of lubricating oil sold annually in West Germany approximately 527,000 tonnes, or 47.5 percent, becomes waste oil requiring safe disposal (Plechatsch, 1981).[24] The sources of the waste oil are shown in Table 2-5. The table also show the percentage of sales of each type of lubricating oil which eventually appear as waste oil.

West Germany, with passage on December 23, 1968, of the *Law Concerning Measures to Assure the Disposal of Waste Oil (Waste Oil Law)*, implemented a comprehensive waste oil collection and disposal system.[25] The system operates through a network of contractors who are licensed to collect and dispose of waste oil from a specified area. Under their contracts the licence holder must:

- collect from any user within their service area all amounts of waste oil over 200 litres;
- provide users with less than 200 litres waste oil with a suitable container the collection of oil at a later date;
- dispose of the collected oil without creating water, soil or air pollution;
- dispose of a minimum of 2,000 tonnes of waste oil per year;

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[24] The review of West Germany's waste oil collection system is based on the works of Irwin and Burhenne (1971), Irwin (1978), Plechatsch (1981), Reese (1983) and OECD (1980).

[25] Gesetz ueber Massnahmen zur Sicherung der Altoelbeseitigung.

TABLE 2-4

LUBRICATING OIL TAXES

Jurisdiction	Date Introduced	Tax Rate	Estimated Annual Revenue (millions)
West Germany	1969 1976	$5.54/100kg $6.65/100kg	$28.9 (1969)
Netherlands	1976	$1.00/1,000 litres	$1.4 (1985)
France	1981	$9.23/tonne	$4.5 (1986)
Italy	1985	$4.92/tonne	$3.5 (1985)
Florida	1986	5¢/gallon	-
Finland	1987	$44.62/tonne	$4.6 (1987)
Norway	1988	9¢/litre	$1.0 (1988)
Rhode Island	1990	5¢/quart	-

- collect the oil free of charge provided the oil contains 10 percent or less foreign matter (such as water, metals, additives, combustion particles, etc.);
- charge the users a fee for the separation of the foreign materials if the foreign materials are greater than 10 percent of the waste oil;
- maintain records on their costs, collections, deliveries, etc.; and
- install specified equipment to measure their disposal of oil.

The federal government reimburses the contractors for the costs of collection, transportation and disposal of the waste oil less any revenue received from the sale of the recycled product. Originally, the reimbursement was done at standard rates which varied according to the method of disposal: DM 12 per 100 kilograms of oil rerefined into lubricating oil, DM 10.2 per 100 kilograms for oil reprocessed into other substances, such as heating oil, and DM 10 per 100 kilograms of oil incinerated. However, in 1976, the rates were all standardized at DM 10 per 100 kilograms of oil. The reduction in the reimbursement rate was possible due to the sharp rise in world oil price which in turn increased the value of the reprocessed oil. In addition, the *Waste Oil Law* allows for additional payments to contractors in cases where collection or disposal of waste oil is unusually difficult.

In order to ensure competition amongst contractors the government ensures that more than one contractor is licensed for each collection area. The contractors may be either private firms or public corporations. The Federal Office also publishes from time to time a list of contractors, their collection areas, and their price for removing foreign substances greater than the 10 percent limit in the Federal Gazette. These measures are important in order to ensure competitive pricing for the removal of foreign substance from the waste oil collected. At the same time, the practice of charging a fee for the cleaning of highly contaminated oil provides a financial incentive for lubricating oil users to keep their waste oil as clean as possible.

TABLE 2-5

SOURCES OF WASTE LUBRICATING OIL IN WEST GERMANY, 1977

Type of Lubricating Oil	Domestic Sales (tonnes)	Waste Ratio (%)	Waste Oil (tonnes)	Share of Total Waste Oil (%)
Motor Oil	449,790	63	283,638	53.8
Metal Processing	98,031	80	78,113	14.7
Machine Oil	148,174	48	71,124	13.5
Transmission Oil	72,724	80	58,179	11.0
Spindle Oil	142,522	13	18,257	3.5
Axle & Dark Oil	23,496	37.5	8,811	1.8
Turbine Oil	8,972	87	7,806	1.5
Cylinder Oil	3,572	30	1,072	0.2
Other*	160,911	0	0	0.0
ALL OILS	1,108,192	47.5	527,000	100.0

* Includes white oil, moulding oil, insulating oil, lubricating grease, and extract from grease refining.

Source: Plechatsch, 1981, Table 1.

TABLE 2-6

RESULTS OF THE WEST GERMAN COLLECTION SYSTEM

(thousands of tonnes)

Year	Lubricating Oil Sales	Waste Oil Generated	Safe Disposal by Reserve Fund	Safe Disposal by Industry*	Unaccounted Waste Oil
1969	976	560	178	290	92
1970	1,087	620	233	300	87
1975	1,027	489	304	177	8
1976	1,982	515	313	193	9
1977	1,108	527	333	185	9
1978	1,130	538	338	192	8
1979	1,150	547	347	193	7

* on site disposal by industrial generators of waste oil.

Source: Plechatsch, 1981, Table 2.

In order to pay for the waste oil collection system, the *Waste Oil Law* created the "Reserve Fund for Assuring Disposal of Waste Oil" (Reserve Fund) which is administered by the Federal Office of Trade and Industry.[26] Revenue for the Reserve Fund comes from a tax on the importation or production of mineral oil. Originally, the tax rate was DM 7.5 per 100 kilograms of oil but was raised to DM 9.0 per 100 kilograms in 1976. In its first two years, 1969 and 1970, the tax raised DM 39.2 million and DM 42.0 million respectively which was collected from approximately 2,000 producers or importers of oil (Irwin and Burhenne, 1971, p.488).

The Reserve Fund also is used to pay the Federal Office of Trade and Industries' administrative expenses which during its first two years were 1.2 and 1.7 percent of the revenues collected (Irwin and Burhenne, 1971). This percentage has risen to 3.8 percent (Plechatsch, 1981). During the first two years of the program nineteen employees of the Federal Office were engaged in the operation of the disposal system.

As shown in Table 2-6, the quantity of waste oil disposed of under the Reserve Fund has almost doubled over the period 1969-1979. In addition, the estimated quantity of unaccounted waste oil disposed of improperly has dropped from 92,000 tonnes to 7,000 tonnes, a reduction of 92 percent. Table 2-7 shows that approximately 91 percent of the waste oil recovered by the collection system is rerefined back into lubricating oils.

TABLE 2-7

DISPOSAL METHOD FOR COLLECTED WASTE OIL
(thousands of tonnes)

Year	Rerefined	Incinerated	Total
1969	172	6	178
1970	203	30	233
1975	266	38	304
1976	281	32	313
1977	303	30	333

Source: OECD, 1980, p. 75.

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[26] Section 1 of the *Act*.

European Economic Community

The success of the West German experience led the Council of European Communities to adopt a directive on waste oil disposal in 1975, which was patterned on the West German law.[27] The directive requires member nations to:

- establish a permit system for the collection and disposal of waste oil;
- prohibit the discharge of waste oil into surface, ground or coastal waters, and drainage systems plus the processing of waste oil which would cause air pollution;
- dispose of the waste oil by means of regeneration or combustion other than destructive incineration;
- require generators, collectors, or disposer of more than 500 litres of used oil a year to maintain records of its oil quantities, qualities, origins, location, and receipt for government inspection; and
- member nations may reimburse collectors and disposers for any unrecovered costs provided that the reimbursements are financed in accordance with the EEC's Polluter Pays Policy - such as through the use of taxes on refined oil, charges on the disposal of used oil, or other mechanisms.

The Netherlands

The Netherlands introduced a tax on lubricating oils in 1978, under provisions of their *Chemical Waste Act of February 11, 1976*.[28] The tax rate was $1.00 per 1,000 litres of lubricating oil and was levied on lubricating oil producers and importers (OECD, 1989). In 1985, the tax generated revenue of approximately $1 million. The tax was replaced in 1988, by a "general fuel charge" which is discussed in Section 3.4 below.

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[27] Council directive on the disposal of waste oils, 75/439/EEC.

[28] *Wet Chemische Afvalstoffen*.

France

In 1981, France implemented a waste oil collection system quite similar to the West German model (OECD, 1989, and Reese, 1983). A network of registered collectors picks up all amounts over 200 litres and delivers the collected oil to a registered disposal sites for recycling or other approved disposal method. The collectors pay 3 centimes per litre for quantities over 1,000 litres and 5 centimes per litre for quantities over 5,000 litres. No charge is paid for quantities under 1,000 litres. The system is funded by a tax on virgin lubricating oil of 40 francs per tonne ($11.01). This tax was originally meant as a temporary measure but has been extended several times. The tax raised 19.4 million francs, or $3.9 million, in 1986.

The tax revenue is allocated to the National Agency for the Recovery and Disposal of Wastes (ANRED) which is responsible for the collection and disposal of waste oil in France. This agency was established by the *Act on Waste Disposal and Recovery of Materials of July 15, 1975.*[29] Article 22 of the *Act* states:

> as a way of helping safeguard the environment, a National Agency for the Recovery and Disposal of Waste is set up, a public State establishment of an industrial and commercial nature, responsible for furthering measures in order to meet the needs of the public interest in the event that private or public resources are inadequate. ... All costs involved in measures regarding the disposal and recovery of waste are covered, inter alia, by fees for services rendered and by the proceeds of parafiscal levies. (Berthelet, 1981).

Thus, ANRED is very similar to a Canadian crown corporation and does not have regulatory powers which is, instead, the responsibility of the Ministry of the Environment and Quality of Life.

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[29] *Loi du 15 juillet 1975 No. 75/633 relative à l'élimination des déchets et à la recuperation des materiaux.*

In 1981, 95,000 tonnes of used motor oil, or 70 percent of total recoverable used motor oil, was collected by the French system (OECD, 1989). However, the recovery of industrial oils has been far less effective.

Italy

Italy imposed its tax on lubricating oils in 1985, at the rate of $4.92 per tonne (OECD, 1989). That year, the tax generated revenue of approximately $3.5 million. The revenue generated is used to fund the collection and disposal of waste oil as required by the EEC directive on waste oil. Since the collection system has been put in place the recovery of used oil has doubled from 55,000 tons to an expected 105,000 tons in 1986 (OECD, 1989).

Florida

Florida imposed a tax of 5 cents per gallon of motor oil or other lubricating oil in 1986.[30] Revenue from the tax goes to the state's "Water Quality Assurance Trust Fund". The state estimates that it generated 24 million gallons of used oil in 1989 (Florida, 1989).

Finland

Finland imposed its tax in 1987, at the rate of $44.62 per tonne (OECD, 1989). The expected annual revenue from the tax is approximately $4.6 million.

Norway

Norway's tax on lubricating oils was introduced in May 1988, to fund the collection and disposal of waste oils. The tax rate is approximately 9 cents per litre and was expected to raise revenue of $1 million annually (OECD, 1989).

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[30] Florida R.S. §206.9935.

Rhode Island

A tax of 5 cents per quart (5.3 cents per litre) of lubricating oil became effective on January 1, 1990, as one of the state's taxes on "hard-to-dispose materials".[31] Revenues derived are credited to the "Hard-to-Dispose Material Account". The tax is collected by retailers.

Comments

The lubricating oil taxes appear to have been implemented in lieu of a user charge for the disposal of the waste oil. However, the quantity of waste oil generated varied substantially amongst the different types of lubricating oils as shown in Table 2-5. For example, the use of a litre of motor oil would on average generate 0.63 litres of waste oil while the use of transmission oil would generate 0.8 litres of waste oil. Indeed, some uses of lubricating oils do not generate any waste oil but are instead totally consumed during use. Nevertheless, the tax rate amongst the different types of lubricating oils is constant. If the tax is viewed as a user charge for disposal of the waste oil then the charge should be higher for users of oil types whose use produces more waste oil. Using our earlier example, the DM 9 per 100 kilograms of oil tax translates to a users charge of DM 14.29 per 100 kilograms of waste motor oil and to DM 11.25 per 100 kilograms of waste transmission oil. Thus, the use of a constant tax rate for all lubricating oil types imposes some inequities. Nevertheless, the administrative costs of a tax rate which varied by oil type may well outweigh the added benefits to society.

It appears that most of the lubricating oil taxes are collected at the manufacturing or wholesale levels which are generally easier to administer and enforce than a tax at the retail level. The taxes have been shown to be an effective means of funding waste oil collection and disposal systems used by the various European countries surveyed.

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[31] Rhode Island R.S. §44-44-3.7.

2.5 BEVERAGE CONTAINER HANDLING FEES AND TAXES

Beverage containers have frequently been targeted for action by governments concerned about litter and post-consumer wastes. This became particularly true starting in the late 1960s when the use of non-refillable beverage containers increased rapidly. The additional environmental problems associated with the use of non-refillable, as opposed to refillable, containers are discussed in detail in Section 4.2. The sheer number of beverage containers used by a society can be staggering. For example, in British Columbia alone approximately three quarters of a billion beer and soft drink containers are used each year (Stone, 1988). Discussed below are two fiscal measures which have been applied to beverage containers to assist with litter control: handling fees and taxes.

Handling Fees

Several jurisdictions have implemented handling fees as part of their mandatory beverage container deposit/refund systems. These deposit systems are discussed in detail in Section 4. Handling fees are fees paid by a beverage manufacturer, usually soft drinks bottlers or brewers, to a retailer for each container returned through the retailer for the refund of the deposit.[32] The fees were implemented to recognise the part retailers play in the return of beverage containers in a deposit system. Table 2-8 summarizes the handling fees used in North America. Most fees are implemented at a flat rate per container or for each size or type of container. However, three states, Vermont[33], Delaware and Florida[34], have made the fee a fixed percentage of the deposit/refund value.

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[32] The handling fee could also be paid to a collection depot operator as is the case in Alberta and Saskatchewan.

[33] Vermont R.S. Title 10 §1522.

[34] Florida R.S. §403.7198 3(f).

Taxes

Norway introduced a 30 percent tax on non-returnable beverage containers in 1974. The purpose of the tax was to remove the non-refillable metal can from the beverage container market. The tax has been very successful in achieving this goal as it is reported that the sale of beer in cans fell from 12 million cans in 1973, to only 1.4 million in 1975, a 88 percent reduction in can use (OECD, 1978).

Sweden introduced a low tax of 2 öre per non-refillable container in 1973.[35] The purpose of the tax was both revenue generation, with the funds to be used to finance food subsidies (OECD, 1978), and to promote the use of refillable containers. The tax has led to a switch from non-refillable bottles to refillable bottles, however, non-refillable cans have maintained their market share (Reese, 1983). Revenues collected are deposited into the "Litter Control Account".

Finland introduced a tax on non-refillable beverage containers in 1976. The tax per litre varies from a low of 0.35 marks for beer containers to a high of 2.9 marks for soft drinks in glass or metal containers (OECD, 1989). The tax was introduced to support the country's deposit-refund system for refillable containers. Non-refillables are reported to account for less than 5 per cent of the market share of beverages.

The State of Rhode Island introduced a 4 cent per case tax on soft drinks or beer distributed in the state in 1984.[36] The tax is simply a revenue generation instrument with the proceeds being deposited into the "Litter Control Account" and dedicated to the funding of state and community recycling programs. The tax is collected at the wholesale level. It is estimated that the tax will generate revenue of between $1.0-1.5 million annually.

In 1989, both Ontario and Manitoba imposed taxes on alcoholic beverage containers which are not subject to a deposit or collected through a recognized recycling system. This would typically include wine, liquor, and imported beer containers. In Ontario, the tax has been set at 5 cents per container and will generate an estimated $4 million annually (Ontario, 1989, p. 25). The Manitoba tax was set at 5 cents for aluminum and other cans and for bottles less than 750 ml and at 10 cents for beer bottles and other bottles greater than or equal to 750 ml (Manitoba, 1989). The tax will raise an estimated $0.1 million annually.

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[35] 1973 *Ordinance Concerning Charges on Certain Beverage Containers* implemented under the 1964 *Nature Conservancy Act* (Reese, 1983).

[36] Rhode Island R.S. §44-44-3.

Comments

Handling fees can be thought of as a user charge for the retailers' costs of handling the return of beverage containers. This fee would of course be incorporated to some degree into the wholesale price bottlers charge retailers which, in due course, would be passed on to consumers. Handling fees typically do not generate revenue for government as it is only a mandated transaction between bottlers and retailers.[37] From a government perspective the fees should be relatively easy to administer as government agencies would only have to act on complaints of non-payment from retailers.

Norway's tax was specifically designed to eliminate the can from the beverage container market by raising the price of beverages sold in non-returnable containers relative to the price of beverages sold in refillable containers. As the beverages sold in the two container types are almost perfect substitutes, the demand for beverages sold in non-refillable containers should be highly responsive to changes in price relative to beverages sold in refillable containers and indeed, this was the case in Norway.

Manitoba's tax of 5 cents on beer in aluminum cans and 10 cents on beer in non-refillable bottles should promote the use of aluminum cans over the use of non-refillable bottles. It is not clear if the intent of the tax was to promote the use of aluminum cans but it could certainly be the result.

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[37] Saskatchewan is an exception where the 2 cent handling fee is paid to the provincial government who in turn reimburses the depot operators for the non-refillable containers returned.

TABLE 2-8

BEVERAGE CONTAINER HANDLING FEES AND TAXES

Jurisdiction	Date Introduced	Tax Rate (cents per container)	Estimated Annual Revenue ($ million)	Type
CANADA				
Alberta	1972	1.5	-	Handling Fee
Manitoba	1989	5 & 10	0.1	Tax
Ontario	1989	5	4	Tax
P.E.I.	1977	3-10	-	Handling Fee
Saskatchewan*	1988	2	-	Handling Fee
USA				
Connecticut	1980	1-2	-	Handling Fee
Rhode Island	1984	4 per case	1-1.5	Tax
New York	1983	1.5	-	Handling Fee
Florida	1989	20% of refund value	-	Handling Fee
Vermont	1973	20% of refund value	-	Handling Fee
Delaware	1981	20% of refund value	-	Handling Fee
EUROPE				
Norway*	1974	30%	-	Tax
Sweden*	1973	2 öre	-	Tax
Finland*	1976	0.35-2.9 marks/litre	-	Tax

* Non-refillable containers only.

2.6 LITTERABLE PRODUCT TAXES

Over the last quarter century society has become increasingly mobile. At the same time the use of disposal, or so-called "throw away" packaging has become common place. These factors together with the general population growth have resulted in dramatic increases in roadside and recreation area litter problems in many jurisdictions. In response some jurisdictions have turned to deposit systems, as discussed in Section 4.2, as a means of litter control. Others have adopted general litterable product excise taxes as a means of funding litter clean up and control programs. Reviewed below are the litterable product taxes and control programs of three U.S. states. Table 2-9 provides a summary of the litterable product taxes currently in use.

TABLE 2-9

SUMMARY OF GENERAL LITTERABLE PRODUCT TAXES

Jurisdiction	Year Introduced	Tax Rate (%)	Estimated Annual Revenue
Washington	1971	0.015	$1,200,000 (1977)
Nebraska	1981	0.015	$550,000 (1985)
New Jersey	1986	0.030 Retail 0.025 Wholesale	-

Washington State

With the passage of its *Model Litter Control Act*, Washington State became the first jurisdiction to impose a general litterable product tax.[38] The *Act* also prohibited littering, imposed fines for littering, provided for the placement of litter receptacles, mandated the use of litter bags in vehicles and watercraft, and provided for a state funded anti-litter campaign. The *Act* became law on May 21, 1972.

The purpose of the tax was to allocate a portion of the cost of the State's anti-litter program to "those industries manufacturing and/or selling products and the packaging, wrappings, or containers thereof which are reasonably related to the litter problem within this state".[39] Table 2-10 lists the product categories covered within the *Act* by this definition. The tax rate is 15/100 of one percent of:

- the value of products manufactured and sold in the state including by-products; or
- the gross proceeds of the sales of the business within the state at the wholesale and/or retail level.[40]

The tax is collected by the State's Department of Revenue which credits the revenues collected, as well as all fines collected, to a "litter control account" for use by the Department of Ecology in its litter control program.[41] In 1977, the tax yielded revenues of $1.2 million.

In 1979, the *Act* was amended to become the *Model Litter Control and Recycling Act*. The purpose of the *Act* was expanded to include the stimulation of private recycling programs. Funds collected in the litter control account are allocated annually on the following basis:

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[38] R.C.W., 1989, §70.93.

[39] §70.93.140 (2) of the *Act*.

[40] §70.93.120 of the *Act*.

[41] §70.93.180 of the *Act*.

- 40-50% to the "litter patrol program to employ youth from the state to remove litter from places and areas that are most visible to the public";
- 20-30% to litter control public education and awareness programs; and
- 20-30% to recycling programs.

Nebraska

Nebraska introduced an "annual litter fee" on October 1, 1981, which was patterned after the Washington State experience.[42] The tax rate of 0.015 percent is the same as Washington's rate. Revenue from the tax goes to a "Litter Fee Collection Fund" and is used to fund state and local anti-litter programs and local recycling grants. The number of product categories subject to the tax is almost identical to Washington's tax, as shown in Table 2-10. In 1985, the tax generated revenue of $550,000. In 1986, the tax revenues were allocated on the following basis:

- 45% for public education;
- 10% for roadside clean up; and
- 45% for community recycling programs.

New Jersey

New Jersey introduced its litterable product tax in 1986, as part of its *Solid Waste Management Act*.[43] The tax rate for litter generating products sold within the state is 0.03 percent at the manufacturing and wholesaling level, and 0.025 percent for litter products sold at the retail level. Retailers selling less than $250,000 of litter generating products are exempted from collecting the tax. Products covered by the tax are listed in Table 2-10.

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[42] *Nebraska Litter Reduction and Recycling Act*, §81-1560.01.

[43] New Jersey R.S. §13:1E-99.1.

TABLE 2-10

PRODUCTS SUBJECT TO THE LITTERABLE PRODUCT TAXES

Product Category	Washington	Nebraska	New Jersey
Food for Human or Pet Consumption	x	x	x
Groceries	x	x	x
Cigarettes and Tobacco Products	x	x	x
Soft Drinks and Carbonated Waters	x	x	x
Beer and other Malt Beverages	x	x	x
Wine	x	x	x
Liquor		x	x
Newspapers and Magazines	x		x
Household Paper and Paper Products	x	x	x
Glass Containers	x	x	x
Metal Containers	x	x	x
Plastic or Fibre Containers made of Synthetic Material	x	x	x
Cleaning Agents and Toiletries	x	x	x
Non-drug Drugstore Sundry Products	x		x
Motor Vehicle Tires			x

Comments

Litterable product taxes are quite effective in generating revenue for the funding of litter control programs. However, they do not provide an economic incentive for the purchaser of a commonly littered product to refrain from littering. The taxes, due to the low tax rates imposed, should have only a small impact on the quantity of litterable products purchased. In addition, the tax cannot be thought of as an effective user charge for the cleanup of litter, as the tax is borne by all consumers of the products and not only by those who litter. The taxes are also imposed ad valorem which means that the tax is not directly related to the volume of packaging material used with each product. As the 'eye-sore' costs of litter are determined by the volume of litter the litterable products taxes should be related to the volume of the packaging material used, and to the probability that the packaging material of each product type will be littered, if the taxes are to be truly equitable.

2.7 ENERGY CONSERVATION TAXES ON DURABLE GOODS

On October 6, 1973, Egypt and Syria attacked Israel starting the Yom Kippur War and bringing an end to cheap world oil prices. The arab members of the Organization of Petroleum Exporting Nations (OPEC), notably Saudi Arabia and Kuwait, maintained an oil embargo in support of the arab cause on western nations friendly to Israel from October 1973, to March, 1974. The embargo was followed by OPEC well-head oil price increases which saw the bench mark price of Saudi Arabia light crude oil increase from \$2.18 per barrel in 1971, to \$5.11 per barrel in October, 1973, and to \$11.65 by January, 1974 (all prices given in U.S. dollars) (Howe, 1979). Further price increases would follow.

The rapidly increasing cost of energy, coupled with increasing environmental concerns related to the use of fossil fuels, has led some governments to introduce excise taxes on durable goods whose use requires large quantities of energy. Large automobiles in particular have been a favourite target as discussed below.

Canada

In May 1974, Canada's Minister of Finance, in response to the then growing energy crisis, proposed in his budget speech to implement four special excise taxes as a means to promote energy conservation. He stated:

> All of us have become more conscious that we need to economize in our use of energy, particularly petroleum. I propose a measure which will make some contribution to this end.
>
> Effective tonight, a special excise tax is to be introduced on high-energy consuming vehicles. This will include large, heavy cars, high-powered motorcycles, privately-owned aircraft and large power boats. (Canada, 1974a, p. 14-15).

This measure did not go into effect as planned as the budget was defeated in the House of Commons. After the general election which resulted from the budget defeat the measure was re-introduced by the same Minister in the fall budget of that year (Canada, 1974b, p. 25). The taxes were implemented under amendments to the *Excise Tax Act*.[44]

As shown in Table 2-11, the tax on high-energy consuming automobiles was based on the weight of the vehicle over a specified threshold weight and the rate increases with each additional 100 lbs of vehicle weight. For the other vehicle types the tax was imposed ad valorem; at 10 percent for both pleasure boat motors greater than 20 HP and privately-owned aircraft, and at 5 percent for heavy motorcycles.

In 1976, the tax rate on passenger vehicles was raised by $10-30 per 100 lbs over the threshold weight and the threshold weight was lowered by 75 lbs for passenger cars and by 100 lbs for station wagons. In introducing this measure the Minister of Finance stated:

> The purpose of the tax is not to raise revenue but to encourage Canadians to demand and the auto industry to produce lighter,

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[44] *Excise Tax Act*, R.S.C. 1985, c. E-15.

> more energy-efficient cars. (Canada, 1976, p. 27)

In the 1976 federal budget the Minister of Finance also introduced an additional "energy conservation" tax on automobile air conditioners. He stated:

> Studies indicate that motor vehicle air conditioners increase fuel consumption by as much as 20 per cent. Consequently, effective tonight the budget introduces a specific excise tax of $100 on air conditioners for use in automobiles, station wagons, vans and smaller trucks. (Canada, 1976, p. 27)

In the 1978 federal budget the tax on motorboat engines, private aircraft and motorcycles were repealed. The Minister, in that years budget speech, stated:

> In my view the special 10 per cent excise tax on marine engines and private aircraft and the 5 per cent tax on motorcycles are having adverse economic effects. The contribution of these taxes to energy conservation has been minimal. (Canada, 1978, p. 12).

Table 2-12 lists the revenues raised over the period 1974-1987, by the federal energy conservation tax measures. The revenue from the tax on high energy consuming vehicles peaked in 1977/78 at $19.8 million, but quickly fell off as the demand for large cars fell due mainly to the large fuel price increases, and as manufacturers strove to make all of their cars lighter and more fuel efficient. The revenue derived from the tax on auto air conditioners now dwarfs the revenue from the auto weight tax.

TABLE 2-11

FEDERAL EXCISE TAX RATES ON HIGH ENERGY CONSUMING MOTOR VEHICLES

Period Covered	Weight Threshold (lbs)	First Excess 100 lbs. ($)	Second Excess 100 lbs. ($)	Third Excess 100 lbs. ($)	Each Succeeding 100 lbs. ($)
Passenger Cars					
Nov. 19/74 to Aug.31/76	4,500	20	25	30	30
After Sept.1/76	4,425	30	40	50	60
Station Wagons					
Nov. 19/74 to Aug. 31/76	5,100	20	25	30	30
After Sept. 1/76	5,000	30	40	50	60

Source: *Excise Tax Act (Canada).*

TABLE 2-12

FEDERAL ENERGY CONSERVATION TAX REVENUE

($thousands)

Year	High Energy Motor Vehicles	Large Motorcycles*	Pleasure Boats Motors > 20 H.P.*	Auto Air Conditioners
1987/88	1,018.4	-	-	64,506.4
1986/87	870.8	-	-	54,871.7
1985/86	1,056.9	-	-	54,073.3
1984/85	1,108.7	-	-	38,401.0
1983/84	672.4	-	-	27,737.7
1982/83	989.9	-	-	19,698.4
1981/82	1,255.4	-	-	25,686.4
1980/81	789.2	123.4	12.8	24,712.8
1979/80	2,075.8	239.1	230.0	29,240.2
1978/79	5,865.2	2,138.4	2,875.4	23,747.9
1977/78	19,787.1	2,671.6	3,355.7	12,012.0
1976/77	12,262.6	1,969.1	3,221.8	12,428.3
1975/76	9,440.8	1,192.2	3,046.5	N.A.
1974/75	2,196.0	519.0	660.9	N.A.

Source: Public Accounts of Canada.

* Repealed November 17, 1978.

United States

As part of the *Energy Tax Act of 1978*[45], the U.S. introduced a "gas guzzler" tax on automobiles.[46] The tax is based on the vehicle's rated fuel mileage, as determined by the Environmental Protection Agency, and became effective with 1980 model year cars. As shown in Table 2-13, the tax, in its first year, started with cars with fuel mileage of less than 15 miles per gallon (mpg) and varied from $200-$550. However, the minimum mileage rating required to be exempted from the tax increased to 17 mpg in 1981, 18.5 mpg in 1982, 19 mpg in 1983, 19.5 mpg in 1984, 21 mpg in 1985, and finally 22.5 mpg in 1986. The upper end of the tax range increased each year; to $650 in 1981, $1,200 in 1982, $1,550 in 1983, $2,150 in 1984, $2,650 in 1985 and $3,850 in 1986. The complete range of tax rates for the 1986 and later model year cars is also shown in Table 2-13.

The tax is collected from the car manufacturer which should make collection relatively easy. Emergency vehicles and vehicles designated by the Secretary of Transport as non-passenger vehicles were exempt. The *Act* also allowed the Secretary to prescribe special tax rates for manufacturers producing less than 10,000 cars per year. See McDonald (1979) for a more complete review and analysis of the *Act*.

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[45] Public Law No. 95-618.

[46] Internal Revenue Code §4064.

TABLE 2-13

U.S. GAS GUZZLER TAX RATES

Automobile Fuel Efficiency (Miles per U.S. Gallon)	Tax Rate ($/car)
1980 Model Year Cars	
at least 15	0
at least 14 but less than 15	200
at least 13 but less than 14	300
less than 13	550
1986 or Later Model Year Cars	
at least 22.5	0
at least 21.5 but less than 22.5	500
at least 20.5 but less than 21.5	650
at least 19.5 but less than 20.5	850
at least 18.5 but less than 19.5	1,050
at least 17.5 but less than 18.5	1,300
at least 16.5 but less than 17.5	1,500
at least 15.5 but less than 16.5	1,850
at least 14.5 but less than 15.5	2,250
at least 13.5 but less than 14.5	2,700
at least 12.5 but less than 13.5	3,200
less than 12.5	3,850

Source: U.S., *Energy Tax Act of 1978.*

British Columbia

On March 11, 1980, British Columbia introduced its own gas guzzler tax on automobiles. The government's rationale was:

> To increase our energy security the government has established a policy framework for developing British Columbia's own untapped potential and reducing our dependence upon oil. ... as a means of encouraging conservation of gasoline use in passenger automobiles the sales tax rate applied to the purchase of new automobiles will be altered to favour more fuel efficient vehicles. Effective midnight tonight, new cars with high fuel efficiency will be subject to a reduced Social Services Tax rate of two percent. New cars with poor fuel efficiency will be taxed at a six percent rate, while vehicles with mid-range fuel consumption ratings will remain subject to the general four percent Social Services Tax levy. (British Columbia, 1980).

Table 2-14 lists the fuel efficiency ratings used to determine a vehicle's relevant tax rate. Any new automobile which did not have a Transport Canada rating was taxed at the six percent rate. Recreational vehicles, vans, trucks, buses and used vehicles continued to be taxed at the general sales tax rate of four percent.

The government repealed the tax in 1983, stating "with energy prices now closer to world levels, it is no longer necessary to offer a graduated Social Service Tax rate as an added incentive to purchase fuel efficient automobiles" (British Columbia, 1983).

TABLE 2-14

BRITISH COLUMBIA'S TAX ON FUEL INEFFICIENT CARS, 1980

Social Service Tax Rate	Transport Canada Rating Code
2%	8.5 or less
4%	greater than 8.5 but less than 13.0
6%	13.0 or greater

Source: British Columbia, 1980.

Ontario

As one of its environmental initiatives in 1989, the Province of Ontario levied a tax on "new, fuel-inefficient cars sold in Ontario" (Ontario, 1989, p. 5). The tax is based on the vehicles fuel consumption rating as issued by either Transport Canada or the vehicle's manufacturer. The tax rates, which starts with vehicles with fuel consumption ratings equal to 9.5 litres/100 km, are shown in Table 2-15. The tax will be rebated if the vehicles are converted to natural gas or propane within 180 days of purchase provided the conversion is to a single-use alternative fuel.

The tax was implemented under amendments to the *Retail Sales Tax Act*.[47] It is estimated the tax will raise $8 million annually.

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[47] *An Act to amend the Retail Sales Tax Act*, S.O. 1989, c. 38, s. 4.

TABLE 2-15

ONTARIO'S TAX ON FUEL INEFFICIENT CARS, 1989

Highway Fuel Consumption Ratings (L/100 Km)	Tax ($/Car)
9.5 - 12.0	600
12.1 - 15.0	1,200
15.1 - 18.0	2,200
Over 18.0	3,500

Source: Ontario, 1989.

Comments

These taxes were introduced to promote energy conservation, however, the taxes are indirectly, not directly, linked with fuel consumption. For example, while the consumption of gasoline per kilometre travelled may be greater for large vehicles, the owner of a large vehicle may drive less than an owner of a small vehicle. In addition, the tax rate for owners of similar cars is the same irrespective of the amount they are used. The tax has no effect on the fuel consumption decisions of consumers who own the current stock of vehicles, or on new car owners once the vehicle is purchased. A tax levied directly on fuel consumption would appear to be a far more efficient means to promote energy conservation. However, a tax on energy consuming durable goods may be viewed as more equitable than an increase in the tax on fuels as the durable goods tax will probably be borne more by upper income households.

The difference in the effects of a direct tax on gasoline and a tax on energy consuming durable goods is shown in Figure 2-1. In the figure, D_1 is the initial demand curve for gasoline and P represents the world price for gasoline, which we will assume is fixed giving rise to a perfectly elastic (horizontal) supply curve. Under these conditions Q_1 would represent the market clearing quantity of gasoline. If an excise tax on gasoline of T were introduced it would shift the supply curve up to P+T, and result in the demand for gasoline dropping from Q_1 to Q_2. If instead, a tax on energy consuming durable goods was introduced, the result would be an inward shift of the demand curve, say from D_1 to D_2 or D_3. The extent of the inward shift would determine the extend of the reduction in the demand for gasoline. In the case of a shift from D_1 to D_2 the reduction in demand would be minor, to Q_3, while a shift to D_3 would result in a major reduction in demand, to Q_4. In the case of the "gas guzzler" taxes reviewed above the shift in demand may be assumed to be minor as the tax would only effect a portion of the total car market, would only effect new car purchasers, and may in fact encourage consumers to keep older less fuel efficient cars running longer.

When the federal excise taxes on energy consuming durable goods were introduced it was federal government policy to keep the price of crude oil sold in Canada below world oil prices.[48] This "made in Canada" energy pricing policy promoted energy consumption while at the same time the excise taxes and other energy conservation measures[49] were attempting to reduce energy consumption. Thus, the federal government's goals were, in this case at least, quite contradictory.

British Columbia's, Ontario's, and the U.S.'s vehicle taxes are more directly related to fuel consumption as the tax rates are based on the fuel efficiency rather than the federal tax which is based on weight. While vehicle weight is positively related to fuel consumption it is not the only determinant of a vehicle's fuel efficiency.

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[48] See the Economic Council of Canada (1985) for a review of Canada's national energy policies and conflicts.

[49] For example, the Canadian Home Insulation Program (CHIP) was introduced by the federal government in June, 1977.

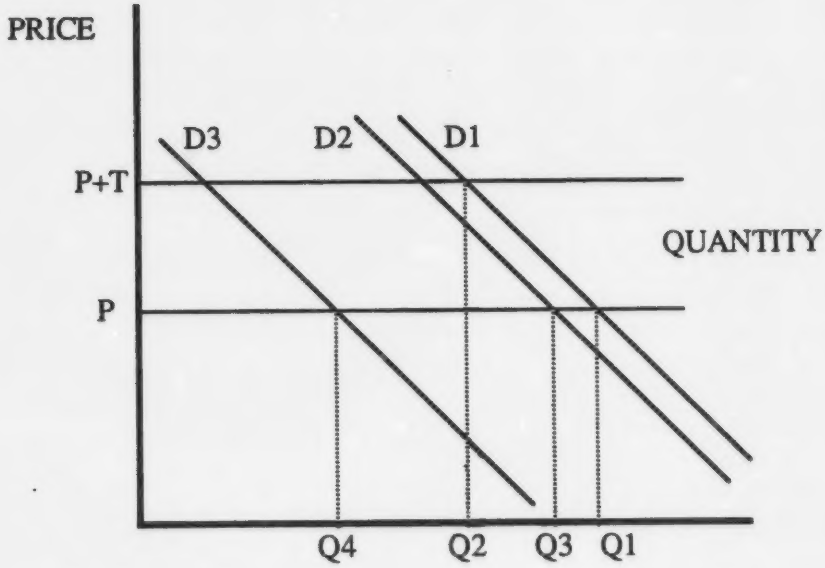
PRICE
D3
D2
D1
P+T
QUANTITY
P
Q4
Q2
Q3
Q1

Figure 2-1
A Comparison of the Changes in the Demand for Gasoline
Due to Taxes on Durable Goods and Taxes on Gasoline

2.8 BATTERY TAXES

The typical lead-acid motor vehicle battery contains approximately 10 kg. of lead and lead oxide and a volume of sulphuric acid (Wilson, 1976), both of which are classified as special wastes in British Columbia.[50] Batteries, if disposed of at landfills, can cause ground water and soil contamination, and, if incinerated, can cause significant air pollutant emissions. Household batteries can also present an environmental problem as many contain mercury and/or cadmium. Discharges of mercury to the environment from household batteries can be quite significant, for example, they account for 17 percent of mercury discharges in France, 25 percent in Switzerland, and 30 percent in Denmark (Berthelet, 1981; Schärer, 1981; Welinder, 1981).

Lead-acid Batteries

Washington State, with the passage of its *Waste Not Washington Act*, implemented a tax on lead-acid batteries (Powell, 1989).[51] The tax of $5.00 per vehicle battery is charged by retailers only if the customer does not bring in a scrap battery for exchange.[52] A consumer, who does not return a battery at the time of purchase of the new battery has up to 30 days from the time of purchase to return a battery in return for the refund of the $5.00 charge. In many ways this tax acts like a deposit system by promoting the return of the batteries to the retailer for collection and disposal. The *Act* also included a ban on the landfilling of lead-acid batteries.

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[50] See British Columbia (1988) for a description of the classification of special wastes in British Columbia.

[51] Codified as RCW 70.95.37 to 46.

[52] A "vehicle battery" is defined as a battery capable of use in any vehicle, having a core of elemental lead, and a capacity of six or more volts (R.C.W. 70.95.37(4)).

Florida imposed a tax of $1 per lead-acid battery in 1986.[53] Revenue from the tax is credited to the "Water Quality Assurance Trust Fund". Florida estimates that 3-4 million spent batteries are produced each year (Florida, 1989).

Maine imposed a tax on lead-acid batteries of $1.00 per battery effective July 1, 1990.[54] The tax is in addition to the battery deposit system put in place in 1989 (see Section 4.4 for a review). This tax is one of a series of "advance disposal fees" the state is bringing in. Funds collected by the tax are credited to the "Maine Solid Waste Management Fund". The tax is collected by battery retailers.

Minnescta imposed a $5 surcharge on the sale of lead-acid batteries effective October 3, 1989.[55] The surcharge is not collected if the consumer exchanges a battery at time of purchase. Alternatively, the consumer can return a battery within 30 days of purchasing the new battery in exchange for a refund of the surcharge. Retailers are allowed to retain any unrefunded surcharges. Lead-acid battery retailers are required to accept all lead-acid batteries returned by consumers free of charge but do not have to accept more than 5 batteries from any one person at one time. Previously the state had banned the disposal of lead-acid batteries in mixed municipal wastes.

Household Batteries

Sweden implemented a tax on batteries containing mercury or cadmium in 1987, at the rate of approximately $4.95 per kilogram of battery sold (OECD, 1989). The purpose of the tax is to provide an incentive to reduce the use of mercury and cadmium in batteries. Sweden aims to reduce emissions of mercury and cadmium from batteries by 75 percent, in part through the use of the tax. Revenue from the tax is used to finance public information programs on batteries and to pay for the final disposal of batteries collected by municipally run collection programs. Approximately 50% of the mercury content of batteries sold in Sweden are returned through their collection program (Swedish Association for Public Cleansing and Solid Waste Management, 1988).

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[53] Florida R.S. §206.9935.

[54] Maine R.S. 38 §1604.

[55] Minnesota R.S. 325E.115.

Norway implemented a tax on batteries containing mercury and cadmium in 1989. The tax rate is set at approximately $0.40 per battery and is expected to raise $7.7 million annually (OECD, 1989).

Comments

Washington's and Minnesota's taxes were not implemented in lieu of a user charge on the disposal of the battery but rather as an incentive for consumers to return the spent battery to retailers for collection and disposal. The household battery taxes appear, in the case of Norway, to have been implemented in lieu of a user charge for their collection and disposal, while Sweden's appears to have been imposed to reduce the use of heavy metals as well.

If Sweden's tax is collected at the manufacturing and importer level the tax should be relatively easy to administer. The use of a flat rate per battery in Norway makes the collection of their tax simpler, although it would be inequitable when comparing batteries of different sizes and heavy metal contents.

2.9 NEWSPRINT TAXES

Newsprint accounts for approximately ten percent of the municipal waste stream in most jurisdictions (for example, see Bird and Hale Ltd., 1979). Because this one product makes up such a significant portion of the municipal solid waste stream, and because it can be recycled relatively easily, it has become a prime target for household recycling programs. Unfortunately, the flood of recyclable newsprint which has recently become available means that the markets for this material have, in many areas, been swamped. In an attempt to increase the demand for recycled newspaper many jurisdictions have introduced procurement policies which favour government purchases of paper containing post-consumer fibre.

Others have, or are considering imposing regulations which would require newsprint to contain a specified percentage of recycled fibre. Still others contemplate the use of excise taxes.

Florida

Florida introduced a "product waste disposal fee" on newsprint effective January 1, 1989.[56] The tax of 10 cents per ton of newsprint is collected from producers and publishers based upon the total weight of newsprint consumed. The use of recycled newsprint is exempted from the tax. Revenue collected is transferred to the "Solid Waste Management Trust Fund". If by October 1, 1992, the recycling rate for newsprint reaches 50 percent the tax will automatically be rescinded. However, if the 50 percent recycling rate is not met by that date, the tax will automatically increase to 50 cents per ton. The tax raised revenue of only $20,000 in 1988/89 and is forecast to raise $90,000 in 1989/90 (Florida, 1989).

Wisconsin

Wisconsin has set newsprint recycling content targets for newspapers printed or distributed in the state starting in 1992.[57] The targets are for a post consumer recycled fibre content of 10% starting in 1992, 25% starting in 1994, and 45% starting in 2001. Publishers who fail to meet these targets must pay a "Newspaper Recycling Fee". The fee is 1% of the total cost of newsprint used during the year multiplied by the publisher's "recycling status" which is equal to the recycling target for the year, specified above, minus the actual recycled content of the newsprint consumed, expressed as a percentage. Thus, newspapers which meet their targets pay no fee while the fee progressively increases for those who fail to meet their targets. The fees collected will be placed into the state's Recycling Fund. However, the fee will not be collected from a publisher if the publisher submits documents which show that the publisher was unable to obtain from producers sufficient quantities of recycled newsprint.

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[56] Imposed by the *Florida Resource Recovery and Management Act*, R.S. §403.7195.

[57] Wisconsin R.S. §159.31.

Comments

Both Florida's and Wisconsin's newsprint tax would appear to have two functions. First, the tax serves in lieu of a user charge for newsprint that is not recycled. Second, it acts as an inducement for newspaper publishers to ensure their newsprint is recycled and also acts as an inducement for them to purchase recycled paper. The second function aims to increase the demand for recycled newsprint. However, it is questionable if the very low tax rate employed by Florida will provide much of an inducement for newsprint users. Wisconsin's tax measure could have a much greater impact on the demand for recycled newsprint as the recycling fee could be as high as 10% in 1991 and increase to a maximum of 45% by 2001.

2.10 PACKAGING MATERIAL TAXES

Packaging materials are estimated to account for over 30 percent by weight of household solid wastes (U.S., 1974a). As a result governments have been examining the use of several legislative instruments in an attempt to reduce packaging material's share of the waste stream. The instruments include the selective banning of certain packaging materials, the requirement that packaging material contain a specified percentage of recycled material, and the use of tax measures. Two packaging tax measures are reviewed below.

Italy[58] imposed a tax of 100 lira (approximately 9 cents) on each non-biodegradable plastic shopping bag effective February 1, 1989 (International Environment Reporter, 1989 and OECD, 1989). A non-biodegradable plastic bag is defined as any plastic bag which is less than 90 percent biodegradable. The tax is collected from bag manufacturers and importers.

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[58] The tax was included in the *Law of 9th November 1989 on Control of Industrial Waste.*

Florida has established provisions for the implementation of an "advanced disposal fee" on containers.[59] If by October 1, 1992, the Department of Environmental Protection determines that containers made of glass, plastic, aluminum, plastic coated paper or other metal are not being recycled at the rate of 50 percent, an advanced disposal fee of 1 cent per container will be implemented. The fee would be collected by retailers. The funds collected, less administrative costs, would go to a "Container Recycling Trust Fund". The funds would be used as part of the state's litter control program to pay for capital grants, research and development, litter control and public education.

Comments

Italy's plastic bag tax would appear to have been implemented as an incentive to reduce the demand for plastic bags. It is reported that the average cost of producing a plastic bag in Italy is 20 lira, therefore a tax of 100 lira should greatly impact the demand for the bags (OECD, 1989). Florida's tax allows container manufacturers the opportunity to increase the recycling rate for their containers and thus avoid the tax. However, if manufacturers do not respond then the tax will serve in lieu of a user charge for the disposal of the containers.

2.11 WHITE AND BROWN GOODS TAXES

White good is the industry term used to describe major household appliances such as washers, dryers, refrigerators, freezers, stoves, hot water tanks, etc. Brown goods are major electronic products such as stereos, televisions, or computers. These products, due to their bulk, can take up a significant amount of space if disposed of in a landfill. As landfill capacity is becoming a scarce commodity in many areas, jurisdictions are examining the use of excise taxes to fund a more appropriate disposal method.

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[59] Florida R.S. §403.7197.

Maine imposed, effective July 1, 1990, a tax on white and brown goods of $15.00 each.[60] Maine defines a brown good as an electronic device of more than 10 pounds, containing printed circuit boards, capacitors, resistors, or transistors that is not a white good. White goods are defined as any appliance employing electricity, natural gas or any liquified petroleum gas to supply heat or motive power to preserve or cook food, to wash clothing, dishes, kitchen utensils, glasses or other related items or to cool or heat air or water. Funds collected go to the "Maine Solid Waste Management Fund".

Comments

The collection of white goods for their scrap metal value by private industry will fluctuate with the world price of metals and with the distance the material must be hauled. These two factors may, in many areas, necessitate government support for the collection of these goods in order to ensure that they are recycled. If a tax is imposed in lieu of a user fee it would be best if the tax was based on the volume of the good rather than a flat rate, as will be used in Maine. However, this may be impractical to enforce. Another alternative would be to charge an ad valorem tax as the value of a white good will in part be determined by its size.

2.12 NOISE RELATED TAXES

During the late 1960s the rising airport traffic at the Paris airport of Orly, and later at Roissy, created significant noise pollution problems (Thiem, 1981). Prompted by a series of court cases launched by nearby residents the government of France responded with a decree which established a compensation fund for those affected by the air traffic noise.[61] Those affected could apply for compensation for the installation of double-glazed windows or other sound proofing measures or for the buy out of their property by government.

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[60] Maine R.S. Title 36 §4831-4834.

[61] *Décret No. 73-193 du 13 février 1973.*

The noise pollution compensation system was funded by a levy on air passenger travel originating or ending in France.[62] The levy was collected from airlines at the rate of one franc per passenger on domestic flights, and three francs per passenger on international flights.

Comments

While the French air passenger levy conformed to the polluter pay principle it was criticized for two failings (Thiem, 1981). First, the levy was not directly related to the noise level generated by the passenger aircraft. For example, Thiem (1981, p. 168) cites the case of "300 passengers on the relatively quiet Airbus pay F900 whereas 100 passengers on the much noisier Concorde pay only F300". Second, there was no obvious reason why internal flights should have a lower levy than international flights. The levy in its original form provided no incentive for an airline to use quieter aircraft. However, it was a simple levy to collect and administer. In response to the criticisms, the French government changed the charge in 1984 to a fee on aircraft landings based on the noise level of the aircraft (OECD, 1989).[63] However, in 1987, the new charge was cancelled due to legal concerns.

2.13 MISCELLANEOUS PRODUCT TAXES

Rhode Island implemented a series of taxes on "hard-to-dispose materials" effective January 1, 1990. Included in this list were taxes of:

- 10 cents per gallon of antifreeze (2.64 cents per litre);
- 1/4 cent per gallon of organic solvents; and
- $3.00 per new motor vehicle, levied on the vehicles registration fee.

Funds collected go to the state's "Hard-to-Dispose Material Account".

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[62] Article 4 of the decree.

[63] *Décret No. 84-29 du 11 janvier 1984 relatif à la redevance pour alternation des nuisances phoniques sur les aérodromes d'Orly et de Rossy-Charles de Gaulle.*

Florida in 1986, implemented a tax on solvents of 10 cents per gallon.[64] Funds collected go to the state's "Water Quality Assurance Trust Fund".

New Mexico placed a 30 cent "beautification fee" on vehicle registration on July 1, 1985.[65] Funds collected go to the state's "Litter Control and Beautification Fund".

2.14 SUMMARY

Table 2-16 provides a summary by jurisdiction of the consumer level environmental excise taxes described in this section. Florida, followed by Rhode Island and Ontario, have made perhaps the most extensive use of consumer level environmental excise taxes.

Of the 64 taxes reviewed 45 were implemented mainly to serve in lieu of a user charge for the disposal of the good. A further 18, mainly leaded gasoline taxes and energy conservation taxes, were implemented to reduce the demand for the good. Only one, France's air passenger tax, was implemented to fund the compensation of pollution victims. The revenue derived from the taxes imposed by U.S. states almost invariably went to dedicated accounts established to fund the collection and disposal of the waste products. In Canada, the taxes employed by the federal government and the provinces were, in most cases, employed to reduce the demand for the specific good, in contrast the taxes used in the U.S. were mainly imposed in lieu of a user charge.

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[64] Florida R.S. §205.9935.

[65] New Mexico R.S. §67-16-14.

TABLE 2-16
A SUMMARY OF CONSUMER LEVEL ENVIRONMENTAL EXCISE TAXES

Jurisdiction	Product	Tax Rate	Year Introduced	Purpose
CANADA				
Federal	High Energy Consuming Veh.	$20-60/100lb.	1974	Energy Cons.
	Large Motorcycles	5%	1974	Energy Cons.
	Pleasure Boat Motors > 20 HP	10%	1974	Energy Cons.
	Private Airplanes	10%	1974	Energy Cons.
	Auto Air Conditioners	$100 per unit	1976	Energy Cons.
	Leaded Gasoline	1/3¢/litre	1987	Lead Emis.
		1¢/litre	1989	Lead Emis.
Alberta	Bev. Containers	1.5¢/cont.	1971	Litter
British Columbia	Fuel Inefficient Automobiles	2-4%	1980	Energy Cons.
	Leaded Gasoline	2¢/litre	1987	Lead Emis.
Manitoba	Leaded Gasoline	0.9¢/litre	1985	Lead Emis.
		1.8¢/litre	1988	
	Liquor, Wine & Beer Conts.	5-10¢/cont.	1989	Solid Waste
New Brunswick	Leaded Gasoline	2.2¢/litre	1989	Lead Emis.
Newfoundland	Leaded Gasoline	1.5¢/litre	1989	Lead Emis.
Ontario	Leaded Gasoline	3¢/litre	1988	Lead Emis.
	Auto Tires	$5.00/tire	1989	Solid Waste
	Fuel Inefficient Vehicles	$600-3,500 per veh.	1989	Energy Cons.
	Liquor, Wine & Beer Containers	5¢/cont.	1989	Solid Waste
P.E.I.	Bev. Containers	3-10¢/cont.	1977	Litter
Saskatchewan	N.R. Bev. Conts	2¢/cont.	1988	Litter
	Leaded Gasoline	2¢/litre	1989	Lead Emis.

TABLE 2-16 CONTINUED

Jurisdiction	Product	Tax Rate	Year Introduced	Purpose
U.S.A.				
Federal	Fuel Inefficient Vehicles	$200-550/veh.	1980	Energy Cons.
		$500-3850/veh.	1986	
Washington	Litter Items	0.015%	1971	Litter
	Lead-acid Batteries	$5.00	1989	Solid Waste
	Tires	0.12%	1985	Solid Waste
		$1.00	1989	Solid Waste
Nebraska	Litter Items	0.015%	1981	Litter
New Jersey	Litter Items	0.03% wholesale	1986	Litter
		0.25% retail	1986	
Rhode Island	Bev. Containers	4¢/case	1984	Recycling
	Lubricating oils	5¢/quart	1990	Waste Disp.
	Anti-freeze	10¢/gallon	1990	Waste Disp.
	Organic Solvents	1/4¢/gallon	1990	Waste Disp.
	Tires	$0.50/tire	1990	Waste Disp.
	Motor Vehicles	$3.00	1990	Waste Disp.
New York	Bev. Containers	1.5¢/cont.	1983	Litter
Connecticut	Bev. Containers	1¢/beer cont.	1980	Litter
		2¢/SD cont.	1980	
Vermont	Bev. Containers	20% of deposit	1973	Litter
Delaware	Bev. Containers	20% of deposit	1981	Litter
Florida	Bev. Containers	20% of deposit	1989	Litter
	Tires	50¢/tire	1989	Solid Waste
		$1.00/tire	1990	
	Lubricating Oil	5¢/gallon	1986	Water Qual.
	Lead-acid Batteries	$1.00.battery	1986	Water Qual.
	Solvents	10¢/gallon	1986	Water Qual.
	Newsprint	10¢/ton	1989	Solid Waste
	Containers	1¢/container	1992	Solid Waste
Oregon	Tires	$1.00/tire	1988	Solid Waste
Wisconsin	Tires	$2.00/tire	1988	Solid Waste
	Newsprint	1-10%	1992	Solid Waste

TABLE 2-16 CONTINUED

Jurisdiction	Product	Tax Rate	Year Introduced	Purpose
Minnesota	Tires	$1.00	1985	Solid Waste
	Lead-acid Batteries	$5.00	1989	Solid Waste
Oklahoma	Tires	$1.00	1989	Solid Waste
Maine	Tires	$1.00/tire	1990	Solid Waste
	Lead-acid Batteries	$1.00/battery	1990	Solid Waste
	White Goods	$15.00/item	1990	Solid Waste
	Brown Goods	$15.00/item	1990	Solid Waste
North Carolina	Tires	1%	1990	Solid Waste
Virginia	Tires	$0.50/tire	1990	Solid Waste
New Mexico	Veh. Registration	$0.50/vehicle	1985	Litter
EUROPE				
Norway	N.R. Bev. Conts	30%	1974	Litter
	Lubricating Oils	9¢/litre	1988	Pollution
	Hg/Cd Batteries	$0.40/battery	1989	Pollution
Finland	N.R. Bev. Conts	0.35-2.9 mk./litre	1976	Litter
	Lubricating Oils	$44.62/tonne	1987	Pollution
Sweden	Bev. Containers	2 öre/cont.	1973	Revenue
	Hg/Cd Batteries	$4.95/kg of Hg/Cd	1987	Pollution
West Germany	Lubricating Oils	7.5 D.M./100kg	1969	Pollution
		9 D.M./100kg	1976	
Netherlands	Lubricating Oils	1¢/litre	1976	Pollution
France	Lubricating Oils	40F/tonne	1979	Pollution
	Air Passengers	1-3F/passenger	1973	Noise Control
Italy	Plastic Bags	7¢/bag	1989	Solid Waste
	Lubricating Oils	$4.92/tonne	1985	Pollution

SECTION THREE

EXAMPLES OF INDUSTRY LEVEL EXCISE TAXES

3.1 INTRODUCTION

This section will review the use of excise taxes directed at industry's environmental problems. Examples of the industrial problems to which excise taxes have been applied include hazardous waste disposal, leaking underground storage tanks, SO_2 and CO_2 emissions, oil spill prevention and clean up, ozone layer depletion, pesticide and fertilizer contamination, and worker health concerns. The manner in which the United States is attacking its hazardous waste management problem provides an excellent case study of the use of taxation mechanisms for the purposes of environmental management. For this reason, the U.S. experience is discussed in detail below. This is followed by a review of the other industrial waste problems mentioned above.

3.2 HAZARDOUS WASTE MANAGEMENT IN THE UNITED STATES

The United States has an enormous hazardous waste management problem. It is estimated that the U.S. produces hazardous wastes at a rate of 700,000 tons per day, or 250 million tons per year (U.S., 1987a). To address this problem the U.S. government has enacted four pieces of legislation; the *Toxic Substances Control Act*[1] of 1976, the *Resource Conservation and Recovery Act of 1976*[2], the *Comprehensive Environmental Response, Compensation and Liability Act of 1980*[3], and the *Superfund Amendments and Reauthorization Act of 1986.*[4]

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[1] Public Law No. 94-469, October 11, 1976.

[2] Public Law No. 94-580, October 21, 1976.

[3] Public Law No. 96-510, July 18, 1982.

[4] Public Law No. 99-499, October 17, 1986.

The *Toxic Substance Control Act* (*TSCA*) gives the U.S. Environmental Protection Agency (EPA) the power to identify, regulate and control the entry on to the market of chemical substances and mixtures which present an unreasonable risk of injury to health or the environment.[5] If the EPA determines that the product does pose an unreasonable risk they can amongst other things:

- prohibit its manufacture or distribution;
- limit the amount of its production and/or its concentration; and
- specify quality and safety control requirements in its production.

The purpose of the *Resource Conservation and Recovery Act* (*RCRA*) was to ensure for the prudent management of the hazardous wastes which are allowed to be produced. This includes the establishment of:

- a tracking system for regulation of hazardous wastes from their generation to their final safe disposal;[6]
- a permit system for hazardous waste treatment, storage, and disposal facilities;[7] and
- the regulation of underground storage tanks.[8]

The objectives of the *Comprehensive Environmental Response, Compensation and Liability Act* (*CERCLA*) as amended by the *Superfund Amendments and Reauthorization Act* (*SARA*) includes:

- To provide a program for the identification of potentially dangerous hazardous waste sites and to establish a National Priorities List (NPL) for the clean up of the worst existing sites.[9] As of January 1987, 25,000 potential sites had been reported to the EPA and 952 sites had been put on the NPL (U.S., 1987a).

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[5] Section 6 of the *Act*.

[6] Section 3003 of the *Act*.

[7] Section 3005 of the *Act*.

[8] Section 9001 of the *Act*.

[9] Section 105 of the *Act*.

- To ensure the parties responsible for the creation of hazardous waste sites pay for their clean up by the establishment of the following severe legal liabilities.[10]
    - **Strict Liability** - the EPA has only to show that some of the hazardous wastes at a site came from a generator in order for the generator to be held liable for the site's clean up. The EPA does not have to prove that wilful or inadvertent negligence was involved; and
    - **Joint and Several Liability** - means that any parties responsible for a hazardous site can be sued together or individual for up to 100 percent of the clean up costs.
- To establish a $1.6 billion Hazardous Substance Response Fund to pay for the cleanup of sites were the responsible parties could not be found or held accountable and to provide for emergencies involving hazardous substances.[11] The trust fund is known more commonly as "Superfund". Provisions within *SARA* increased the size of Superfund to $8.5 billion.[12]

In summary, the *TSCA* and the *RCRA* are designed to provide for the effective management of hazardous wastes in the present and the future. The purpose of *CERCLA* and *SARA* is to provide for the clean up of past environmental mistakes and to handle any present environmental emergencies. Ultimately, if *RCRA* is successful in achieving its goals, the need for the Superfund provisions of *CERCLA* will be eliminated.

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[10] Section 107 of the *Act*.

[11] Section 221 of the *Act*.

[12] Section 9507 of the *Act* which also changed the name of the trust fund to the "Hazardous Substance Superfund".

3.3 SUPERFUND TAXES

Aside from appropriations from general government revenue plus clean up cost recoveries and penalties, the majority of the revenue for Superfund has come from four sources:

- an excise tax on petroleum;
- an excise tax on industrial chemicals;
- a hazardous waste disposal tax; and
- an "environmental tax" on business income.

Under the original version of *CERCLA*, only the first three taxes were used and all had an automatic termination date of September 30, 1985.[13] Under *SARA* the two excise taxes were re-introduced[14] effective January 1, 1987, but the hazardous waste disposal tax was repealed.[15] *SARA* also introduced the "environmental tax" on business income as discussed below. All of the remaining taxes are scheduled to terminate on the earlier of:

- December 31, 1992;
- when a total amount collected from all sources reaches $6.65 billion; or
- if by December 31, 1989, or 1990, the unobligated balance of Superfund exceeds $3.5 billion.

Under *CERCLA*, the U.S. Congress had intended to raise $1.6 billion for Superfund of which $1.38 billion was to come from the environmental taxes (Reese, 1983). The remainder would come from appropriations from general revenue, penalties assessed under *CERCLA* and clean up cost recoveries. However, the environmental taxes raised only $1.2 billion over the original five year life of *CERCLA*. (Kozielec, 1989).

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[13] Section 211 of the *Act*.

[14] Sections 511-513 of the *Act*.

[15] Section 514 of the *Act*.

Under *SARA*, the total appropriations for Superfund are to total $8.5 billion over the five year period starting January 1, 1987 (Kozielec, 1989). Of this total, $6.6 billion is to be raised by the environmental taxes, $1.25 billion will come from annual appropriations from general revenue of $250 million, and the remainder will be raised by clean up cost recoveries, penalties and interest earned by the Trust Fund.

Petroleum Tax

CERCLA imposed a tax on crude oil of 0.79 cent per barrel received at a U.S. refinery or petroleum products entered into the US for consumption, use, or warehousing. The tax on crude oil was collected from every operator of a US refinery while the tax on imported petroleum products was collected from the importer. *SARA* re-introduced the tax at the much higher rate of 8.2 cents per barrel of domestic crude oil and 11.7 cents per barrel of imported petroleum products. During the first five years of *CERCLA* the petroleum tax accounted for only 15% of the revenue from the environmental taxes but this has increased to 65.9%, as shown in Table 3-1, under the *SARA* tax increases (Kozielec, 1989).

Industrial Chemicals Tax

CERCLA also imposed a tax varying from $0.24 to $4.87 per ton on 42 different industrial petrochemicals and inorganic chemicals. Table 3-1 lists the tax rate, for each chemical and the quantity of chemicals on which a tax was collected and the revenue raised during 1987. The tax rates were based on the percentage of all hazardous wastes generated attributable to a specific feedstock which was in turn to serve as a proxy for the composition of wastes found at Superfund sites (Carlson and Bausell, 1987). The tax was payable from the manufacturer, producer, or importer of the chemicals. *SARA* re-established the tax at the same rates except for xylene which was increased from $4.87 to $10.13 per ton. The tax on petrochemicals accounted for 28.1% of the total superfund excise tax revenue during 1987, and the tax on inorganic chemicals accounted for a further 6.1% (Kozielec, 1989). Exempted from the tax are:

- methane or butane used as fuel;
- substances used in the production of fertilizer;

- sulphuric acid produced solely as a byproduct of air pollution control;
- substances derived from coal;
- substances used in the production of motor fuel;
- chromium, cobalt, or nickel recycled from solid waste in the U.S.;
- substances used in the production of animal feed; and
- any taxable chemical exported from the U.S.

SARA also introduced a "tax on certain imported substances derived from taxable chemicals" effective January 1, 1989.[16] The tax for each imported substance will be set equal to the amount of the tax which would have been imposed on the taxable chemicals used in the manufacture of the substance if such taxable chemicals had been sold in the United States. The initial list of taxable substances is given in Table 3-2, but other substances can be added if it is determined that taxable chemicals constitute more than 50 percent of the weight of the materials used to produce the substance. Exempted from the tax are substances used in the production of fertilizers or animal feed. The tax is collected from the importer of the taxable substance.

Hazardous Waste Tax

A tax of $2.13 per dry weight ton of hazardous waste received by a "qualified hazardous waste disposal facility" was imposed by the original *CERCLA* and became effective October 1, 1983. Revenue from the tax is credited to the "Post-closure Liability Trust Fund"[17] and totalled $15.6 million during the original five years of *CERCLA* (Kozielec, 1989). The tax was collected from the owner or operator of the facility. The tax and trust fund were repealed by *SARA*, as it was thought that the tax might discourage waste generators from using qualified waste disposal facilities and to avoid penalizing waste generators who were already using these facilities (Kozielec, 1989)

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[16] Section 515 of the *Act*.

[17] Section 232 of the *Act*.

Environmental Tax on Business Income

Under *SARA* a so-called "environmental tax" on business income was created.[18] The tax is 0.12 percent of taxable corporate income over $2 million. The environmental tax is deductible for income tax purposes.

Comments

During its first five years of operation the majority of Superfund revenues came from the petroleum and industrial chemical taxes which together provided annual revenue of approximately $250 million (Carlson and Bausell, 1987). While these taxes were collected from approximately 600 firms, almost half of the revenue were collected from only ten major petroleum and chemical firms. In 1987, a total of 681 firms paid the superfund excise taxes (Kozielec, 1989). Table 3-3 provides a breakdown by type of feedstock of the number of firms from which the tax was collected and the average payment by a firm during 1987. The relatively small base from which the taxes are collected should simplify the administration, monitoring and enforcement of these taxes.

The feedstock taxes could be viewed as being used in lieu of a user charge for the clean up of hazardous waste sites. While the tax is collected from the feedstock producers, it is the feedstock users, the generators of hazardous wastes, which will ultimately pay the tax. However, the feedstock taxes will not provide an incentive for waste generators to reduce their waste production. Also, due to the low tax rates imposed, the feedstock taxes will have little impact on the demand for the feedstocks.

There is, however, an equity question in having current producers and users of feedstocks found at abandoned waste sites pay for these past mistakes. The chemical industry, in particular, views the use of taxes on chemical feedstocks as highly inequitable. They argue that they are paying for the past mistakes of others which they regard as punitive (see for example, the position of the Canadian Chemical Producers' Association (1987)). The chemical industry views the problem of abandoned waste dumps as being "societal" in nature and favour the use of a more broad based financing mechanism to pay for the clean up costs.

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[18] Section 516 of the *Act*.

The perceived need for a more broad based tax measure led to the inclusion of the environmental tax on business income in *SARA*. The advantage of such a broad based tax is its ability to generate substantial revenue without imposing an unacceptable burden on any individual taxpayer. The business tax rate is quite modest and, as it applies only to taxable corporate income above $2 million, will be borne by those with the ability to pay. The $2 million minimum also greatly restricts the number of tax filers subject to the tax, thus making it far simpler to administer.

The purpose of the hazardous waste tax and the Post-closure Liability Trust Fund was to assume liability for any damages resulting from a waste disposal facility which had operated and closed in accordance with all government regulations.[19] Thus, this tax could be viewed more as an insurance premium rather than serving in lieu of a user charge. As such the tax rates should have varied by the type of wastes disposed of, in accordance with the relative risk of each waste type, rather than the use of a flat rate for all waste types.

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[19] Section 107(k) of *CERCLA*.

TABLE 3-1
U.S.A. SUPERFUND FEEDSTOCK TAX RATES AND REVENUES, 1987

Feedstock	Tax Rate		Quantity	Revenue
	U.S. $	Can. $*		$ 000's
Petroleum	(rate per U.S. barrel)		(000's Barrels)	527,431
Domestic Crude Oil	8.2¢	11.4¢	3,145,268	269,519
Imported Petroleum Products	11.7¢	16.3¢	2,303,585	257,912
Petrochemicals	(rate per ton**)		(000's tons)	224,923
Acetylene	4.87	6.77	149	726
Benzene	4.87	6.77	6,094	29,676
Butane	4.87	6.77	744	3,622
Butylene	4.87	6.77	915	4,457
Butadiene	4.87	6.77	1,293	6,296
Ethylene	4.87	6.77	17,898	87,161
Methane	3.44	4.78	2,169	7,462
Naphthalene	4.87	6.77	26	125
Propylene	4.87	6.77	8,535	41,566
Toluene	4.87	6.77	1,920	9,352
Xylene	10.13	14.08	3,404	34,479
Inorganic Chemicals				48,479
Ammonia	2.64	3.67	3,580	9,451
Antimony	4.45	6.18	5	23
Antimony trioxide	3.75	5.21	26	99
Arsenic	4.45	6.18	1	3
Arsenic Trioxide	3.41	4.74	20	68
Barium sulfide	2.30	3.20	n.a.	2
Bromine	4.45	6.18	164	732
Cadmium	4.45	6.18	2	9
Chlorine	2.70	3.75	10,310	27,836
Chromium	4.45	6.18	8	35
Chromite	1.52	2.11	316	480
Potassium dichromate	1.69	2.35	n.a.	1
Sodium dichromate	1.87	2.60	44	82
Cobalt	4.45	6.18	4	20
Cupric sulphate	1.87	2.60	39	72
Cupric oxide	3.59	4.99	14	52
Cuprous oxide	3.97	5.52	5	19
Hydrochloric acid	0.29	0.40	800	232
Hydrogen flouride	4.23	5.88	303	1,281
Lead oxide	4.14	5.75	346	1,433
Mercury	4.45	6.18	20	91

TABLE 3-1 CONTINUED

U.S.A. SUPERFUND FEEDSTOCK TAX RATES AND REVENUES, 1987

Feedstock	Tax Rate		Quantity	Revenue
	U.S. $	Can. $*		000's $
Nickel	4.45	6.18	90	402
Phosphorus	4.45	6.18	358	1,592
Stannous chloride	2.85	3.96	1	4
Stannic chloride	2.12	2.95	11	23
Zinc chloride	2.22	3.08	16	35
Zinc sulphate	1.90	2.64	20	38
Potassium hydroxide	0.22	0.31	256	56
Sodium hydroxide	0.28	0.39	8,935	2,502
Sulfuric acid	0.26	0.36	5,592	1,454
Nitric acid	0.24	0.33	1,482	356
Total				800,833

Source: U.S.A., *Comprehensive Environmental Response, Compensation and Liability Act* and the *Superfund Amendments and Reauthorization Act*, and Kozielec, 1989.

* For any chemical which is a gas the term "ton" means the amount of gas in cubic feet which is the equivalent of 2,000 pounds on a molecular weight basis.

**Conversion to Canadian $ based on average noon spot rate for 1986.

TABLE 3-2

U.S.A. SUPERFUND TAXABLE SUBSTANCES

Cumene
Styrene
Ammonium nitrate
Nickel oxide
Isopropyl alcohol
Ethylene glycol
Vinyl chloride
Polyethylene resins, total
Polybutadiene
Styrene-butadiene, latex
Styrene-butadiene, snpf
Synthetic rubber, not containing fillers
Urea
Ferronickel
Ferrochromium nov 3 pct
Ferrochrome ov 3 pct. carbon
Unwrought nickel
Nickel waste and scrap
Wrought nickel rods and wire
Nickel powders
Phenolic resins
Polyvinylchloride resins
Polystyrene resins and copolymers
Ethyl alcohol for nonbeverage use
Ethylbenzene
Methylene chloride
Polypropylene
Propylene glycol
Formaldehyde
Acetone
Acrylonitrile
Methanol
Propylene oxide
Polypropylene resins
Ethylene oxide
Ethylene dichloride
Cyclohexane
Isophthalic acid
Maleic anhydride
Phthalic anhydride
Ethyl methyl ketone
Chloroform
Carbon tetrachloride
Chromic acid
Hydrogen peroxide
Polystyrene homopolymer resins
Melamine
Acrylic and methacrylic acid resins
Vinyl resins
Vinyl resins, NSPF

Source: U.S.A., *Superfund Amendments and Reauthorization Act.*

TABLE 3-3

NUMBER OF FIRMS PAYING SUPERFUND EXCISE TAXES AND AVERAGE PAYMENTS, 1987*

Excise Tax	Number of Firms	Average Tax Payment
All Excise Taxes	681	$1,176,000
Total Petroleum	382	$1,381,000
Domestic Petroleum	174	$1,482,000
Imported Petroleum	208	$1,296,000
Petrochemicals	162	$1,388,000
Inorganic Chemicals	296	$164,000

* Before adjustments for rebates or refunds.

Source: Kozielec, 1989.

3.4 CHEMICAL TAXES

Washington State estimates that during 1985, a total of 514,713 tons of hazardous wastes were generated by 623 firms in the state (Washington, 1987). To address its hazardous waste management problems Washington State passed its *Model Toxics Control Act* in 1988, the main purpose of which was to "raise sufficient funds to clean up all hazardous waste sites and to prevent the creation of future hazards due to improper disposal of toxic wastes into the state's land and waters".[20] The *Act* specified that the revenues necessary to fund these activities would come from:

- clean up cost recoveries;
- penalties imposed by the *Act*;
- appropriations from state general revenue; and
- a "pollution tax" on "hazardous substances".

The pollution tax was imposed, effective March 1, 1989, on the first possession of a hazardous substance within the state. The tax rate is 0.7% of the wholesale value of the hazardous substance. The term hazardous substance has been defined by the *Act* to include:

- any substance defined as a hazardous substance under Section 101(14) of the federal *CERCLA*;
- petroleum products[21];
- pesticides registered under the *Federal Insecticide, Fungicide and Rodenticide Act*; and
- any other substance defined by the Director of the state's Department of Ecology to present a threat to human health or environment if released into the environment.

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[20] Initiative 97, the *Model Toxics Control Act*, was passed by vote of the people on November 8, 1988, and was proclaimed by the Governor on December 8, 1988.

[21] Petroleum products includes plant condensate, lubricating oil, gasoline, aviation fuel, kerosene, diesel fuel, benzol, fuel oil, residual oil, liquified or liquefiable gases such as butane, ethane, and propane, and every other product derived from refining crude oil, but not including crude oil.

However, the *Act* provides exemptions from the tax for substances which meet one of the following criteria:

- possession of a hazardous substance for personal or domestic uses;
- possession of a quantity which has been determined by the Department of Ecology to be minimal and is possessed by a retailer for the purpose of selling it to the ultimate consumer; and
- possession of alumina or natural gas.

Revenue from the tax is deposited into two accounts; the State Toxics Control Account and the Local Toxics Control Account. Of the total 0.7% tax rate a portion of the revenue from the tax equal to 0.33% is deposited into the state's account and a portion equal to 0.37% is deposited into the local account. Monies in the state's account may be used for, but not limited to:

- state hazardous waste planning, management, regulation, enforcement, technical assistance and public education;
- state solid waste planning, management, regulation, enforcement, technical assistance and public education;
- hazardous waste cleanup program;
- state matching funds required under *CERCLA*;
- financial assistance to local cleanup programs;
- state programs for the safe reduction, recycling or disposal of hazardous wastes from households, small business and agriculture; hazardous material response training;
- water and environmental health protection and monitoring programs;
- public participation programs including regional citizen advisory programs; and
- development and demonstration of alternative management technologies designed to carry out the top two state hazardous waste management priorities.

Monies deposited into the Local Toxics Control Account may be used by the Department of Ecology to provide grants to local governments for the following purposes, ranked in descending order of priority:

- remedial actions at hazardous waste sites;

- hazardous waste plans and programs; and
- solid waste plans and programs.

However, the *Act* also directs that one percent of the funds deposited into the state and local accounts be used for participation grants to persons who may be adversely effected by a release or threatened release of a hazardous substance and to not-for-profit public interest groups.

3.5 TAXES ON FUELS

Special excise taxes have been levied on fuels in response to three specific environmental problems; leaking underground storage tanks and SO_2 and CO_2 emissions.[22] Underground storage tanks are commonly used in the distribution of petroleum products. Leaks from these storage tanks may be hard to detect and if undetected may cause serious soil and ground water contamination (CCREM, 1988). The combustion of high sulphur content fuels can also be a significant source of SO_2 emissions and in many jurisdictions is a major source of these emissions. The potential threat of global warming due to the greenhouse effect resulting from CO_2 emissions is in large measure due to the combustion of fossil fuels.

United States - L.U.S.T. Tax

One of the provisions of *SARA* was the amendment of *RCRA* to address the problems caused by leaking underground storage tanks, known by the acronym of LUST. The U.S. has an estimated one million underground storage tanks and the EPA believes that up to 20 percent of them may be leaking (U.S., 1987a). This is a major concern for the U.S. as over half of its population relies on ground water for its drinking supply (U.S., 1987a). The *SARA* amendments create a $500 million "Leaking Underground Storage Tank Trust Fund" the purpose of which is to provide for the quick clean up of dangerous sites.[23]

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[22] The problems associated with lead emissions are discussed in Section 2.2.

[23] Section 522 of the *Act*.

As with Superfund the LUST Trust Fund is meant to correct past environmental mistakes. The prevention of future problems is tackled by *RCRA* provisions which established new design and construction standards for underground storage tanks and by the requirement for tank owners to maintain financial responsibility for any releases from their storage tanks.[24] The LUST Trust Fund is not intended as a "bail out" for tank owners; instead the EPA will attempt to recover all costs associated with the clean up from the tank owner. Aside from direct clean up costs, the fund will be used to establish a site clean up priority list, determine the appropriate clean up technologies to use, undertake the corrective action, enforce the clean up requirements, and recover the clean up cost.

Revenue for the Trust Fund comes from an excise tax on gasoline and other motive fuels of 0.1 cents per gallon.[25] The tax also covers aviation fuels. The tax came into effect on January 1, 1987, and will terminate on December 31, 1991, or when the net revenues from the tax totals $500 million, whichever comes first.

The Netherlands - Fuel Tax

The Netherlands, under its *Air Pollution Control Act*[26], implemented a tax on fuels in order to assist in the control of SO_2 emissions (OECD, 1980 and Thiem, 1981). Fuel combustion is one of the major sources of SO_2 emissions in the Netherlands. The tax, which came into effect on July 1, 1972, was used to finance 90 percent of the costs of:

- administering the air pollution control licensing system;
- a national air monitoring network;
- scientific research and development;

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[24] See Subtitle I, Sections 9001-9010 of the *Act*. Financial responsibility can be met by the owner having either insurance, guarantee, surety bond, letter of credit, or any other method satisfactory to the Administer of the EPA.

[25] Section 521 of the *Act*. Other fuels includes benzol, benzene, naphtha, casing head and natural gasoline, or any other liquids except kerosene, gas oil, or liquified petroleum gas.

[26] *wet inzake de Luchtverontreininging.*

- compensation of persons suffering irrecoverable losses as a result of air pollution; and
- assistance to firms facing disproportionately high abatement costs.

The tax rates, as shown in Table 3-4, varied by type of fuel and was not directly related to a fuel's sulphur content. In 1979, revenue from the tax totalled 63.2 million guilders ($37.2 million) (OECD, 1980, p. 63).

In 1988, the Netherlands introduced a new general fuel tax at the rates shown in Table 3-5 which replaced their previous fuel tax and four other product charges (OECD, 1989). In addition, the revised tax now provides rebates to industries undertaking flue gas desulphurisation which meets certain emission levels. The revised tax also provides a substantially higher tax rate on leaded gasoline as compared to unleaded gasoline.

Concerns about the potential effects of global warming on their nation and the world led the Dutch government, in its National Environment Policy Plan, to set as an objective the stabilizing of their nations CO_2 emission by the year 2000 at the 1989/90 average level (The Netherlands, 1989). This goal was later strengthened to stabilize their emissions at the 1989/90 level by 1994/95 (Metz, 1990). As part of their emission control strategy, the Netherlands implemented a CO_2 tax on fossil fuels effective February 1, 1990. This tax, sometimes referred to as a carbon tax, is based on the CO_2 generating potential per unit of energy of the different fuels. The tax rates are listed in Table 3-6.

The CO_2 tax is collected as part of the Netherlands' existing fuel excise tax (Metz, 1990). The CO_2 tax has simply been added on to the environmental levy portion of the tax resulting in a levy increase ranging from 5%, for leaded gasoline, to 180% for natural gas (Metz, 1990).

The tax is expected to raise revenue of Dfl 150 million per year, (approximately $100 million). The revenue will be used to finance part of the government's energy conservation program. However, the tax was not as yet meant to have a significant economic regulatory effect, due to the tax's relatively small impact of fuel prices, but rather serve as a revenue mechanism (Opschoor et al., 1990).

Norway - Fuel Sulphur Content Tax

On January 1, 1971, Norway introduced a tax on fuels derived from petroleum, which is partly based on a fuel's sulphur content, as a part of its SO_2 abatement policy (OECD, 1980). Oil use is a major source of SO_2 emissions in Norway. The tax had a base rate of 1 öre/litre of oil, regardless of its sulphur content, and a variable rate calculated on a fuel's sulphur content above 0.5 percent by weight. The total tax per litre, in öre, was calculated as:

$$T = 1.0 + 0.2(SC - 0.5)$$

where T is the tax rate per litre and SC is the sulphur content expressed as a percentage by weight.

In 1976, the tax was modified to allow for rebates on the sulphur content portion of the tax based on any emission abatement measures undertaken by polluters. Thus, the variable portion of the tax, while still quite low, provides a monetary incentive for polluters to reduce their SO_2 emissions.

The tax was levied at the distribution stage on the oil suppliers. In 1977, tax revenue totalled Kr. 69 million ($16.3 million) of which Kr. 15 million ($3.6 million) came from the sulphur content portion of the tax (OECD, 1980). That year sulphur emission rebates totalled Kr. 1.5 million or 10 percent of the sulphur content portion of the tax.

On January 1, 1988, the fuel tax was modified and substantially increased (OECD, 1989). The base tax rate was increased to $42.00 per 1,000 litres of oil. The variable tax on the sulphur content of the oil is determined using the rates shown in Table 3-7. Annual revenue from the tax is expected to be approximately $41.5 million.

TABLE 3-4

THE NETHERLANDS' EXCISE TAX ON FUEL, 1972

Fuel	Tax Unit	Tax Rate	
		(Dfl)	(Can.$)
Gasoline	100 litres	0.59	0.34
Kerosene	100 litres	0.10	0.06
Gas oil and light fuel oil	100 litres	0.10	0.06
Heavy fuel oil	tonne	1.08	0.64
Natural Gas*	1,000 m^3	0.84	0.49
Coal	tonne	0.79	0.46

* includes blast furnace gas, coke oven gas and refinery gas.

Source: OECD, 1980.

TABLE 3-5

THE NETHERLANDS' EXCISE TAX ON FUEL, 1988

Fuel	Tax Unit	Tax Rate (Can.$)	
Gasoline, Unleaded	100 litres	0.15	
Gasoline, Leaded	100 litres	2.68	
Medium/Light Fuel Oil	100 litres	0.15	
Gas Oil (Road Traffic)	100 litres	1.08	
Gas Oil (Other)	100 litres	0.15	
Heavy Fuel Oil/Coal	tonne	3.86	
LPG	tonne	1.92	
Furnace Gas and Others	Gigajoule	0.02	
Natural Gas	1,000 m^3	0.46	
	1,000 m^3	1.46	use of over 170,000 m^3
Petroleum Coke	tonne	3.86	

Source: OECD, 1989.

TABLE 3-6

THE NETHERLANDS' CO_2 TAX RATES

Fuel	Units	Tax Rates	
		Dfl	$
Gasoline	100 litres	0.27	0.18
Heavy Fuel Oil	ton	3.28	2.20
Coal	ton	2.61	1.80
LPG	ton	3.38	2.30
Natural Gas	1000 m^3	1.79	1.20

Source: Metz, 1990.

TABLE 3-7

NORWAY'S TAX ON FUEL SULPHUR CONTENT, 1988

Sulphur Content (% by Weight)	Tax Rate (per 1,000 litres)
0 - 0.25	$3.00
0.25-0.5	$6.00
0.5-0.75	$9.00

Source: OECD, 1989.

Sweden

Sweden brought in a tax on oil products in 1984, with a tax rate of $27.32 per cubic metre of mineral oil (OECD, 1989). The tax is broken down into two parts; a charge of $25.38 per cubic metre was imposed to finance both environmental and non-environmental programs and to stimulate the replacement of imported oils with domestic solid fuels, while a second charge of $1.98 per cubic metre was imposed to pay for measures to control acidification of the environment, particularly the liming of Sweden's lakes (OECD, 1989).

Comments

The U.S. LUST tax is directed not at a problem associated with the consumption of the fuel but rather at problems caused during the distribution of the fuel to its final users. The other taxes reviewed were directed at problems stemming from the combustion of the fuel.

Because Norway's fuel tax provides a rebate for sulphur emissions abated, the tax serves as an emission fee. That is, the sulphur portion of the tax only applies to the sulphur in the fuel which is actually emitted by the firm. The degree to which this will induce firms to undertake abatement measures will depend on the level of the tax relative to the costs of sulphur emission abatement. The ability of the sulphur content portion of the tax to induce firms to substitute low sulphur fuels for high sulphur fuels will depend on the level of the tax relative to the price differential between low and high sulphur content fuels.

The Netherlands's original fuel tax was a poor user charge on SO_2 emissions as it was not based on the sulphur content of the fuel. In addition, the tax did not provide an incentive for firms to substitute low sulphur fuels for high sulphur fuels. Their new tax corrected this failing by providing rebates to firms undertaking flue gas desulphurisation.

3.6 OIL SHIPPING TAXES

The 1960s and early 1970s saw the western world's demand for crude oil, mostly imported, skyrocket. To transport these vast quantities of oil the industry turned to the construction and operation of huge oil supertankers. The use of supertankers, no matter how well constructed, meant that eventually large scale oil spills would and did occur. For example, in 1978, the *Amoco Cadiz* went aground of the coast of Brittany in France spilling 220,000 tons of crude oil destroying fishing grounds, oyster beds, and the local tourist industry. Fishermen, hoteliers and the French government sought damages of more than $2 billion dollars as a result of the spill (International Environment Reporter, 1989). Recently, the major oil spill resulting from the grounding of the *Exxon Valdez* in Alaska's Prince William Sound brought forth further calls for tighter regulation of oil tankers.

The potential for large scale environmental damage from oil spills led several coastal jurisdictions to establish contingency funds for the payment of any oil spill clean up costs. Revenue for the funds came from levies imposed on the shipment of oil within their jurisdiction. Table 3-8 presents a summary of oil shipping taxes used throughout the world which are discussed in detail below.

Canada

Part XX of the *Canada Shipping Act* established the "Maritime Pollution Claims Fund" as an account in the federal government's consolidated revenue fund.[27] The purpose of the fund is to provide compensation for pollution damage caused by ships carrying "pollutants in bulk".

Revenue for the fund came from a levy on each ton of oil imported into Canada as a bulk cargo or shipped as a cargo from any point in Canada.

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[27] *Canada Shipping Act*, R.S.C. 1970, c. S-9, ss. 737-751.

The original levy was set at 15 cents per ton of oil.[28] Payment of the levy is made by the owner, consignee or shipper of the oil and is due before:

- the ship is unloaded for imported oil; or
- the ship leaves the oil loading facility for oil shipped from within Canada.

Between 1972 and 1976, the fund collected $53 million (Swaigen, 1981), but collection of the tax was halted, by Order in Council, on September 1, 1976. Only $600 in compensation had been paid out of the fund as of January 1980 (Swaigen, 1981). The fund has now grown with accumulated interest to approximately $150 million (Canada, 1990).

The 1987 amendments to the *Canada Shipping Act* changed the name of the fund to the "Ship-source Oil Pollution Fund" and raised the levy to 30 cents per tonne.[29] The amendments were necessary as Canada had become a signatory to the 1971 "International Convention on the Establishment of an International Fund for the Compensation for Oil Pollution Damage". The new Ship-source Oil Pollution Fund would be used to meet any Canadian obligations to the international fund. The amendments also contained provisions for the tax rate to be adjusted annually using the Consumer Price Index for Canada excluding the food and energy components. The amendments also allow the Minister of Transport to implement, discontinue or re-implement the levy by Ministerial Order after consulting with the Minister of Fisheries and Oceans, and the Minister of the Environment. The levy has not, as of February 1990, been brought back into effect.

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[28] *Canada Shipping Act*, R.S.C. 1970, c. S-9, s. 748.

[29] *An Act to amend the Canada Shipping Act and to amend the Arctic Waters Pollution Prevention Act, the Maritime Code Act and the Oil and Gas Production and Conservation Act in consequence thereof*, S.C., 1987, c. 7, s. 790.

Maine

Maine's *Oil Discharge Prevention and Pollution Control Act* of 1970, established the "Maine Coastal Protection Fund".[30] This non-lapsing revolving fund is limited to a maximum of $6 million and is to be used for state pollution abatement costs, third party oil spill compensation and research and development. The fund was financed by a tax on oil shipments within the state of 0.5 cents per barrel of crude oil or petroleum product (Thiem, 1981).

In 1985, the fund's name was changed to the "Maine Coastal and Inland Surface Water Oil Clean-up Fund".[31] The fund remained as a non-lapsing revolving fund but the fund's limit was reduced to a maximum of $4.5 million. The new fund is financed by a levy on oil terminal facility operators of:

- 1.5 cents per barrel of unrefined crude oil;
- 1.0 cent per barrel of gasoline; and
- 0.5 cent per barrel of all other refined oil products.

Florida

The "Florida Coastal Protection Trust Fund" was established by the *Oil Spill Prevention and Pollution Control Act* of 1970.[32] The fund is used for the prevention and clean up of oil spills plus the rehabilitation of contaminated areas. Revenue for the fund comes from a tax of 2 cents per barrel of oil transferred within the State and is collected from the terminal facility operator.[33] The fund is a non-lapsing revolving fund capped at $25 million. The tax can be raised to 10 cents per barrel in the event of a "discharge of catastrophic proportions" until the fund regains its $25 million limit.[34]

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[30] Maine R.S. Title 38 §541-560.

[31] Maine R.S. Title 38 §551.

[32] In 1974, the *Act* was amended to become to the *Pollutant Spill Prevention and Control Act*, Florida R.S. § 376.11 et seq.

[33] Florida R.S. §206.9935.

Maryland

The "Maryland Oil Disaster Containment, Clean-Up and Contingency Fund" was established in 1973, to provide funding for oil spill contingency planning and training, and for the costs of oil spill containment, clean up and the rehabilitation of affected areas.[35] Revenue for the fund comes from a levy of 0.75 cent per barrel of oil and petroleum products transferred within the state. The tax is levied only once, at the point of first transfer within the state. The non-lapsing revolving fund is limited to a maximum of $750,000.

Finland

Passage of *Act No. 668 of 22 September 1972 for the Prevention of Oil Damage Caused by Ships* established Finland's "Fund for Compensation for Oil Damage". This "extrabudgetary" fund is for the reimbursement of costs associated with oil spills not recoverable from the ship owner, or where the source of the spill in unidentified. Article 20 of the *Act* establishes an "oil protection levy" of 100 marks per 1,000 tonnes of oil imported. The tax came into effect on November 1, 1972, and is collected by the Customs Department from the person who first reports the oil for custom clearance.

United States

Provisions of the *Outer Continental Shelf Lands Act Amendments of 1978,*[36] established the "Offshore Oil Pollution Compensation Fund". The fund is financed, in part, by a 3 cent per barrel tax on all oil produced on the U.S.'s outer continental shelf. The fund was created to pay for any uncompensated losses resulting from an oil spill associated with oil production on the outer continental shelf. The owners of ships and offshore facilities are held liable for removal costs and damages of oil spills but the *Act* limits their liability where wilful misconduct or gross negligence are not involved (see Krueger and Singer (1979) for a discussion of the liability restrictions).

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[34] Florida R.S. §206.9935 (1) 2 (b) 2.

[35] Maryland R.C. Environment §4-411.

[36] Public Law No. 95-372, September 18, 1978.

Comments

The jurisdictions which have established compensation funds have also imposed legal liabilities on the oil shippers which would attempt to collect all clean up and other related costs from the identified source of the oil spill. The major purpose of the funds are to ensure funding is immediately available to respond to oils spills, without having to wait for compensation through the legal system, and to provide funding where the source of the oil spill cannot be identified, or where compensation from the responsible party cannot be collected. Thus, the oil shipping taxes could be thought of as social insurance premium payments for potential damages to society in general.

TABLE 3-8

OIL SHIPPING TAXES FOR COMPENSATION FUNDS

Jurisdiction	Year Introduced	Tax Rate
Canada	1972	15¢/ton
	1987	30¢/tonne
Florida	1970	2¢/barrel
Maine	1970	0.5¢/barrel of petroleum and petroleum products
	1985	1.5¢/barrel of crude oil 1.0¢/barrel of gasoline 0.5¢/barrel other petroleum product
Finland	1972	150 F.MK./1000 tonnes
Maryland	1973	0.75¢/barrel
United States	1978	3¢/barrel

3.7 COAL MINING TAXES

The United States has imposed taxes on coal produced in the U.S. to deal with two environmental problems; worker health and mine site reclamation.

Black Lung Disease

Black lung disease (pneumoconiosis) is caused by the prolonged inhalation of coal dust by coal mine workers. Passage of the *Black Lung Benefits Revenue Act of 1977*[37] created the "Black Lung Disability Trust Fund" which is used to fund disability payments for miners, and their survivors, where payment cannot be collected from mine operators.[38] Revenue for the trust fund is provided by a tax on coal produced in the U.S. at the rates shown in Table 3-9.[39] The tax rates shown in the table differentiate between underground and surface mined coal. The tax rate is capped at a maximum percentage of the purchase price of coal, as shown in the right hand column of the table. The mining of lignite coal is exempt from the tax.

Mine Site Reclamation

The U.S. *Surface Mining Control and Reclamation Act of 1977* created the "Abandoned Mine Reclamation Fund" as a trust fund to pay for the "reclamation and restoration of land and water resources adversely affected by past coal mining".[40] Revenue for the trust fund comes from a "reclamation fee" imposed effective August 3, 1977, on U.S. mined coal. The tax rate was set at:

- 35 cents per ton of surface mined coal; and
- 15 cents per ton of underground mined coal.

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[37] Public Law No. 95-277, February 10, 1978.

[38] Internal Revenue Code §9501(d).

[39] Internal Revenue Code §4121.

[40] Public Law No. 95-87, August 3, 1977. Codified as 30 USCA §1232.

However, the tax rate is also limited to a maximum of 10 percent of the value of the coal at the mine. In addition, lignite coal is taxed at the rate of 10 cents per ton or 2 percent of its value, which ever is less.

Comments

Both taxes differentiate between surface and underground mined coal, but in different directions. With the black lung coal tax the rate is higher for underground mined coal which is appropriate as the disease is most prevalent among underground miners. The rate is higher for surface mined coal under the reclamation coal tax as surface mines require significantly more in the way of reclamation after closure. Lignite, the poorest grade of coal, is taxed at a lower rate under both tax schemes, possibly to reflect the smaller profit margins which could be derived from its mining, or to keep it competitively priced as an energy source.

TABLE 3-9

BLACK LUNG COAL TAX RATES

Year	Rate Per Ton Mined		Maximum Percentage
	Underground ($)	Surface ($)	(%)
1978	0.50	0.25	2
1982	1.00	0.50	4
1986	1.10	0.55	4.4
2014	0.50	0.25	2

Source: U.S., *Black Lung Benefits Revenue Act of 1977*, and *Internal Revenue Code §4121.*

3.8 OZONE DEPLETING SUBSTANCES TAXES

Chlorofluorocarbons (CFCs) and brominated compounds (Halons) are very stable non-toxic non-flammable substances which have been used widely as aerosol propellants, as refrigerants in refrigerators, freezers, air conditioners and heat pumps, as blowing agents in the manufacture of insulation and packaging materials, as solvents for cleaning electrical components, and as a fire extinguisher. Concerns over the use of these compounds rose in the early 1970s when researchers linked CFCs with stratospheric ozone depletion (Molina and Rowland, 1974). The ozone (O_3) layer in the stratosphere acts to shield the earth from harmful ultraviolet radiation. Current scientific theory suggest that the CFCs and Halon gases when released into the atmosphere migrate upward to the stratosphere where they are broken down by ultraviolet light, releasing free chlorine and bromine which act as a catalyst in the break down of ozone. The problem is compounded by the extremely long atmospheric life-time of these compounds which, as shown in Table 3-10, can range from 25 to 380 years.

The potential health and environmental effects of increased ground level ultraviolet radiation levels due to the depletion of the ozone layer includes (U.S., 1987b):

- increased incidence of melanoma skin cancer;
- increased incidence of eye cataracts;
- suppression of the human immune system;
- damage to plant life;
- damage to aquatic organisms;
- accelerated weathering of outdoor plastics; and
- increased formation of ground level ozone.

In addition, CFCs are considered to be a greenhouse gas which could potentially contribute to the problem of global warming.

Concerns over the use of CFCs led to a ban on the use of CFCs as a propellant in aerosol cans by the United States in 1978, along with similar bans by Canada, Sweden, Norway and Denmark (Morrisette, 1989). Aerosol cans had, at that time accounted for fifty percent of total U.S.

consumption of CFCs (U.S., 1987b). However, non-aerosol consumption of CFCs continued to increase as did evidence of ozone layer depletion, such as the discovery of a hole in the ozone layer over the antarctic. These actions prompted the recognition of ozone depletion as a global problem calling for international action. This led to the adoption of the "Vienna Convention for the Protection of the Ozone Layer" in March 1985, by 43 countries. The convention serves as a framework for more specific protocols and subtreaties on the international regulation of ozone depleting substances. In September 1987, the "Montreal Protocol on Substances that Deplete the Ozone Layer" was signed. The protocol stipulates that consumption of CFCs in developed countries is to be frozen at the beginning of 1989, at the 1986 consumption levels and that consumption is to be decreased to 80 percent and 50 percent of 1986 consumption levels by 1994, and 1999, respectively.[41] The protocol also stipulates that Halon consumption is to be frozen at 1986 consumption levels by 1993 (see Morrisette (1989) for a detailed review of the history of CFC regulation and the Montreal Protocol).

Both Canada and the United States are signatories to the Montreal Protocol and both have chosen to implement their obligations under the Protocol through a system of transferable production quotas.[42] Under these systems domestic producers and importers are assigned a production quota of 80 percent of their 1986 production level. Trading of these quotas would be permitted which would allow firms with low cost reduction alternatives to sell their quotas to firms with high cost reduction alternatives. Economists argue that this type of system, which provides firms with incentives to make cost effective reductions, will minimize the total cost to society of meeting regulatory goals (see Tietenberg (1985) for a review of the economic theory behind emission trading).

Canada and the U.S. both realized that the system of allocating production quotas held the potential for producers to gain windfall profits from the reduction in ozone depleting substances production (Canada, 1989c; U.S., 1987b). Figure 3-1 shows how the windfall profit might arise.

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[41] Based on the total ozone depleting potential of the chemicals.

[42] In Canada the quota system for CFCs was implemented by the *Ozone-depleting Substances Regulation No. 1*, SOR/89-351, under the *Canadian Environmental Protection Act*, S.C. 1988, c. 22.

In the diagram S and D represent the initial supply and demand curves for ozone depleting substances which result in a market clearing price and quantity of P_1 and Q_1 respectively. With the quota system in place production is limited to quantity Q_2, at which consumers would be willing to pay a price of P_2 while production costs would fall to P_3, leaving a windfall profit for producers equal to area P_2ABP_3.[43]

An excise tax could be employed to capture some or all of the potential windfall profits for government. For example, in Figure 3-2 an excise tax of T is imposed on ozone depleting substances shifting the supply curve upward from S to S+T. In our example the revenue generated by the tax would be TxQ_2, which is equal to the area P_4CBP_3 in the diagram and the producers share of the windfall profits would be reduced to area P_2ACP_4. The tax could be set to recover all or part of the windfall profit provided that government had a good estimate of the demand curve for ozone depleting substances. The maximum rate for the tax would be P_2-P_3. Any rate higher then that would reduce the demand for ozone depleting substances below Q_2.

In the *Omnibus Budget Reconciliation Act* of 1989, the U.S. government imposed an excise tax on ozone-depleting chemicals effective January 1, 1990.[44] The chemicals included under the tax are CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, Halon-1211, Halon-1301, and Halon-2402.[45]

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[43] This analysis assumes that there would be no inward shift of the demand curve due to the introduction of replacements for the current uses of ozone depleting substances.

[44] Public Law No. 101-239, Section 7506. Codified as U.S. Internal Revenue Code, Sections 4681-4682..

[45] The full chemical names for the ozone depleting substances are:
CFC-11 - fluorotrichloromethane
CFC-12 - dichlorodifluoromethane
CFC-113 - 1,1,2-trichloro-1,2,2-trifluoroethane
CFC-114 - 1,2-dichloro-1,1,2,2-tetrafluoroethane
CFC-115 - 1-chloro-1,1,2,2,2-pentafluoroethane
Halon-1211 - bromochlorodifluoromethane
Halon-1301 - bromotrifluoromethane
Halon-2402 - dibromotetrafluoroethane.

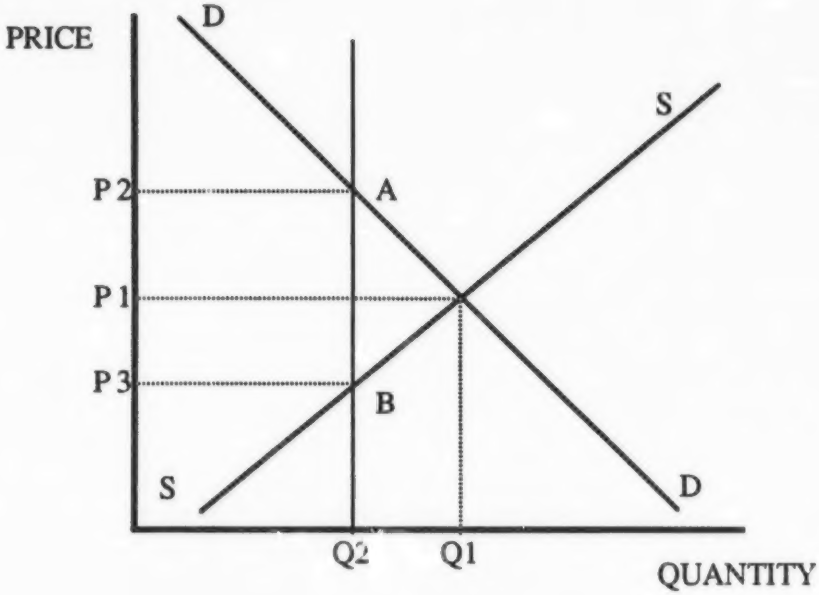
PRICE
D
S
P2
A
P1
P3
B
S
D
Q2
Q1
QUANTITY

Figure 3-1

Effects of a Supply Quota

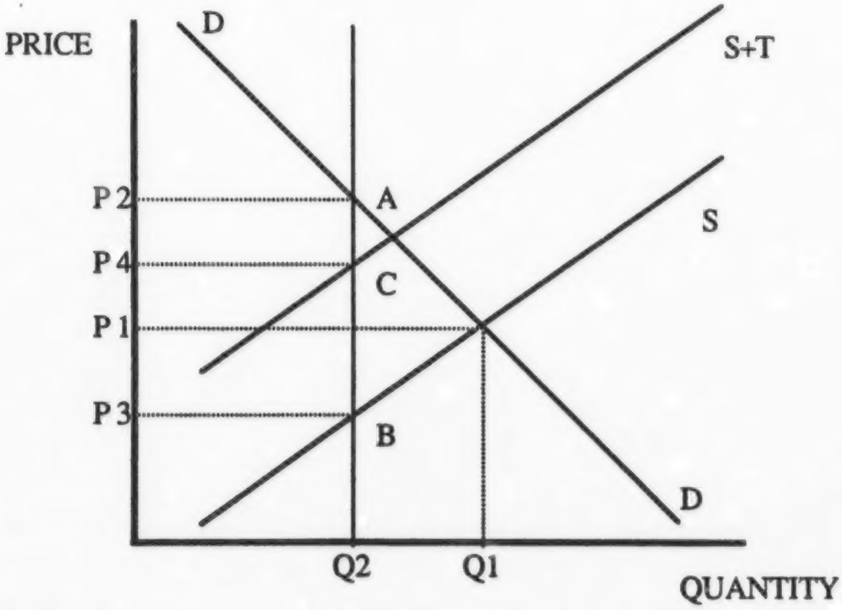
PRICE
D
S+T
P2
A
S
P4
C
P1
P3
B
D
Q2
Q1
QUANTITY

Figure 3-2

Supply Quotas and Excise Taxes

The tax is calculated for each chemical by multiplying a base tax rate by the ozone-depletion factor of the chemical which are shown in Table 3-10.[46] The base tax rate is $1.37 per pound for 1990 and 1991, rises to $1.67 per pound in 1992, and to $2.65 per pound in 1993. After 1994, the base rate increases each year by 45 cents per pound.

The *Act* exempts ozone-depleting chemicals used as feedstocks where the chemical is entirely consumed in the manufacture of another chemical or where the chemical is recovered as part of a recycling process. The *Act* also exempts, during 1990 only, the Halon chemicals and CFCs used in the production of rigid foam insulation. In addition, halon and ODS used in the production of rigid foam insulation have had their tax rates substantially reduced for the period 1991 through 1993. The percentage of the tax otherwise payable during the phase-in period are shown in Table 3-11.

For imported products, a tax is imposed if ozone-depleting chemicals are incorporated into the product or released into the atmosphere in the process of manufacturing the product. The tax is collected when the product is sold or used by the importer of the product.

Comments

By adjusting the base rate by each chemical's ozone depleting potential, the tax acts as an incentive to reduce the use of high ozone depleting chemicals in favour of chemicals with a lower depletion factor.

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[46] See Section 4681 and 4682 of the U.S. Internal Revenue Code.

TABLE 3-10

OZONE DEPLETION FACTORS

Compound	Life-time (years)	Ozone Depleting Potential*
CFC-11	75	1.0
CFC-12	111	1.0
CFC-13	n.a.	0.45
CFC-112	n.a.	0.96
CFC-113	90	0.8
CFC-114	185	1.0
CFC-115	380	0.6
Halon-1211	25	3.0
Halon-1301	110	10.0
Halon-2402	n.a.	6.0

* Measured relative to CFC-11 which is set to 1.0. Values are reported on a mass basis (i.e. per kilogram).

Source: U.S., 1987b and Technology Review Panel, 1989.

TABLE 3-11

HALON AND ODS IN RIGID FOAM INSULATION TAX REDUCTIONS, 1991-1993

	Percentage of Tax Payable During		
	1991	1992	1993
Halon-1211	6.0	5.0	3.3
Halon-1301	1.8	1.5	1.0
Halon-2402	3.0	2.5	1.6
ODS in Rigid Foam Insulation	18.0	15.0	10.0

For example, the tax on Halon-1301 during 1991, would have been \$1.67 x 10.0 = \$16.70 per pound (the 1991 tax rate times Halon-1301's ozone depleting potential). However, the tax reduction reduces the tax payable to \$16.70 x 0.018 = \$0.30 per pound (the tax otherwise payable times the reduction percentage expressed as a decimal).

3.9 PESTICIDE TAXES

Rachel Carson with the publication of her book *Silent Spring* in 1962, brought to world attention the potential dangers of the widespread use of organic chemical pesticides, notably DDT (short for dichloro-diphenyl-trichloro-ethane). When introduced, DDT was hailed as a miracle chemical due to its ability to control insect borne diseases such as malaria and the discoverer of its use as an insecticide was awarded a Nobel Prize. However, DDT is fat-soluble and once it enters the body will be stored in the fatty tissues. As DDT enters the food chain it eventually concentrates in the higher order animals, including humans. In addition, some insect pests developed immunity to the chemical. Their population could then grow unchecked while their natural predators were eliminated by the chemical. The heavy use of pesticides can also result in the contamination of surface water, ground water and soils.

The increasing awareness of these potential dangers led to bans on the use of DDT in many countries[47] and tight regulation of the sale and use of pesticides and herbicides.[48] Some jurisdictions are now examining the possibility of using excise taxes as a means of encouraging pesticide users to switch to other pest control methods, such as biological controls.

Sweden, as part of its pesticide control program, implemented a tax on pesticides in 1984. The tax rate is approximately $1.00 per kilogram of active ingredient and is expected to generate revenue of $1.1-$2.2 million per annum (OECD, 1989).

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[47] For example, in 1970, Sweden banned the use of DDT and Canada has restricted its use to small quantities since then. The U.S. has restricted its use to cases of extreme health emergencies since 1973.

[48] Pesticides are regulated in Canada by the *Pest Control Products Act*, R.S.C. 1985, c. P-9. See Canada (1984) for review of pesticide control in Canada. In British Columbia the regulation of pesticides is conducted under the *Pesticide Control Act*, R.S.B.C. 1979, Chap 322.

3.10 FERTILIZER TAXES

The heavy or prolonged use of fertilizers can lead to the runoff of nutrients into surrounding surface and the contamination of ground waters. In surface waters the increased nutrients can lead to increased plant and algae growth which can lower the water's oxygen content below that required to support aquatic organisms.

Sweden implemented a tax on fertilizers in 1984. The tax rate is $0.12 per kilogram of nitrogen and $0.06 per kilogram of phosphorous contained in the fertilizer (OECD, 1989). The tax generates an estimated $21.5 million in revenue. It is reported that the tax has increased the average price of fertilizer by 5 percent which has not significantly affected the demand for fertilizer use (OECD, 1989).

3.11 LIVESTOCK FODDER TAXES

In the Netherlands animal manure production is a major source of acid deposition, eutrophication and soil pollution (OECD, 1989). As part of its manure control program the Netherlands imposed a tax of $0.09 per tonne of livestock fodder (OECD, 1989). The tax generates annual revenue of approximately $4 million.

Comments

The tax appears to have been implemented in lieu of a user charge for the government's costs of controlling animal manure.

3.12 SUMMARY

Table 3-12 provides a summary of the 22 industry level environmental excise taxes reviewed in this section. As can be seen the United States has made, by far and away, the greatest use of industry level taxes.

TABLE 3-12

A SUMMARY OF INDUSTRY LEVEL ENVIRONMENTAL EXCISE TAXES

Jurisdiction	Product	Tax Rate	Year Introduced	Purpose
CANADA				
Federal	Oil Shipping	30¢/tonne	1972	Oil Spills
U.S.A.				
Federal	Oil-Continental Shelf	3¢/barrel	1978	Oil Spills
	Oil-Domestic	8.2¢/barrel	1980	Haz. Wastes
	Oil-Imported	11.7¢/barrel	1980	Haz. Wastes
	Chemicals	$0.22 to $10.13/ton	1980	Haz. Wastes
	Motor Fuels	0.1¢/U.S.Gal.	1986	L.U.S.T.
	Coal Surface Mined	25¢/ton	1978	Black Lung Disease
		50¢/ton	1982	
		55¢/ton	1986	
	Coal Underground Mined	50¢/ton	1978	Black Lung Disease
		$1.00/ton	1982	
		$1.10/ton	1986	
	Coal Surface Mined	35¢/ton	1977	Reclamation
	Coal Underground	15¢/ton	1977	Reclamation
	CFCs and Halon	$1.37/pound	1990	Ozone Layer
		$1.67/pound	1992	
		$2.65/pound	1993	
Florida	Oil Shipping	2¢/barrel	1970	Oil Spills
Maine	Oil Shipping	1.5¢/barrel	1970	Oil Spills
Maryland	Oil Shipping	0.75¢/barrel	1973	Oil Spills
Washington	Chemicals	0.7%	1989	Haz. Wastes

TABLE 3-12 CONTINUED

A SUMMARY OF INDUSTRY LEVEL ENVIRONMENTAL EXCISE TAXES

Jurisdiction	Product	Tax Rate	Year Introduced	Purpose
EUROPE				
Netherlands	Fuels	Variable	1972	SO_2 Emis.
	Livestock Fodder	$0.09/tonne	-	Pollution
Norway	Fuels	Variable	1971	SO_2 Emis.
Sweden	Fuels	$1.98/m^3	1984	SO_2 Emis.
	Fertilizers	$0.12/kg. of N	1984	Nutrients
		$0.06/kg. of P	1984	Nutrients
	Pesticides	$1.00/kg.	1984	Pollution
Finland	Oil Imports	$30.77 per 1,000 tonnes	1972	Oil Spills

SECTION FOUR

EXAMPLES OF MANDATORY DEPOSIT SYSTEMS

4.1 INTRODUCTION

The purpose of a deposit is to provide an economic incentive for consumers to return a product to a collection point in exchange for the refund of all or part of the deposit value. Mandatory deposits can also be viewed as an excise tax on the non-return of a specific product to a designated collection system. Traditionally, deposits have been mandated for beverage containers as a method of litter control. However, the use of deposits has been expanded to include products as diverse as auto batteries and car bodies.

4.2 BEVERAGE CONTAINER DEPOSITS

Prior to the 1960s beer and soft drink manufacturers made almost exclusive use of refillable glass containers. Manufacturers included a deposit into the price of the beverage, usually equal to the container's replacement cost, in order to ensure the return of these valuable containers. These voluntary deposit systems achieved a very high return rate without the need for government regulation. However, during the 1960s so-called "convenience" or "one-way" containers entered the market and these non-refillable non-returnable containers soon achieved a large market share. Beverages sold in these containers were of course deposit free. The lower transportation costs of these lighter non-refillable containers resulted in the closure of many smaller bottling operations which were replaced by centralized high volume canning and bottling lines.

The loss of the voluntary deposit systems had several environmental consequences. The most noticeable was a sharp increase in roadside litter. Table 4-1 presents a review of roadside litter surveys which show that beverage containers can account for up to 70 percent of the total litter stream. The results of these studies are sensitive to the method by which litter is measured: by item counts, surface area, volume, or weight. Item count measurements, where every item down to 1 inch in diameter

TABLE 4-1

ESTIMATES OF PROPORTION OF THE LITTER STREAM MADE UP BY BEVERAGE CONTAINERS

Litter Study	Year	Measurement Basis	% of Litter Stream	Source
United Kingdom	-	Unit Count	7	Glass, 1973
Australia	-	Unit Count	8.5-12	Australia, 1974
Sweden	-	Unit Count	12	Lidgren, 1976
Sweden	-	Unit Count	20	Lidgren, 1976
Ontario	-	Unit Count	9	Ontario, 1974
Ontario	-	Unit Count	33	Ontario, 1974
P.E.I.	1974	Unit Count	31	Env. Assoc., 1974
Saskatchewan	1973	Unit Count	33.9-71.6	Sask., 1976
Saskatchewan	1974	Unit Count	36.1-66.2	Sask., 1976
Saskatchewan	1975	Unit Count	34.4-61.5	Sask., 1976
Ohio	1981	Unit Count	21.8-34.3	Systech, 1981
United States	1969	Unit Count	32	U.S., 1975
United States	1969	Unit Count	20	U.S., 1975
United States	-	Volume	54-70	Quarles, 1974
Oregon	1971	Volume	43	Peaker, 1975
Vermont	-	Volume	34	Vermont, 1973
Vermont	-	Volume	57	Vermont, 1973
Ontario	-	Weight	37	Ontario, 1974
New Brunswick	1981	Weight	39.2	N.B., 1988
Hawaii	1978	Unit Count	12.21	Syrek, 1986
Michigan	1978	Unit Count	8.13	Syrek, 1986
Kentucky	1979	Unit Count	15.85	Syrek, 1986
Nebraska	1980	Unit Count	9.00	Syrek, 1986
Washington	1977	Unit Count	4.43	Syrek, 1986
California	1985	Unit Count	4.93	Syrek, 1986

regardless of size is counted as one item, typically present lower estimates of beverage containers' impact on litter. Better measures of litter impacts are volume and surface area measurements, as they provide an indication of the visual impact litter has and its associated "eyesore" costs to the public.

The increasing market share achieved by non-returnable containers is important as studies have shown that non-refillable containers are far more likely to be discarded as litter than are refillable containers. Table 4-2 presents estimates of the average propensity of each type of beverage container to be discarded as litter. The results presented in the table were calculated differently in each jurisdiction, so comparison between jurisdictions is difficult. However, the results consistently show that the non-refillable can is 4.7-12 times more likely to be discarded as litter than the refillable bottle. Non-refillable bottles are only 1.2-9 times more likely to be discarded as litter compared to refillable bottles.

The use of non-refillable containers also results in increased resource and energy use which was accompanied by an increase in the pollution associated with the containers' production. In addition, the introduction of non-refillable containers resulted in an increase in the generation of household solid wastes stretching municipal solid waste collection and disposal services even further. Table 4-3 presents estimates of the air and water pollution resulting from the use of various container types. In the table "trips" refers to the number of times a refillable bottle is reused. The table shows that refillable bottles are the least polluting container type and that the amount of pollution declines as the number of trips increases.

For the reasons outlined above, some jurisdictions, starting in the early 1970s, introduced legislation to create mandatory deposit/refund systems for beverage containers. Their purpose was to reduce litter and to reverse the trend toward the use of non-refillable containers.

TABLE 4-2

AVERAGE PROPENSITY OF BEVERAGE CONTAINERS TO APPEAR IN THE LITTER STREAM

Country	Average Propensity to Appear in Litter		
	Returnable Bottle	Non-Returnable Bottle	Metal Can
Australia[a]	0.68	1.80	5.90
Ontario 1[b]	0.14	0.22	1.70
Ontario 2[b]	0.17	0.20	0.80
Sweden[b]	0.02	0.18	0.22
U.S.A.[a]	0.70	3.80	6.50

a. percent of container type which were littered.

b. container type's percent of total litter divided by container type's percent of total beverage sales.

Source: OECD, 1978, p. 55.

TABLE 4-3

AIR AND WATER POLLUTION FROM FIVE BEVERAGE CONTAINER SYSTEMS IN THE USA

(kg of pollutants per 1,000 litres of beverages)

Container System	Atmospheric Emissions	Waterborne Wastes
Returnable Bottle		
19 Trips	8.5	3.3
10 Trips	11.3	4.2
5 Trips	24.0	8.3
Non-Returnable Bottle	31.3	6.8
Bimetallic Can	26.7	4.1
Aluminum Can	38.8	7.1
Plastic Bottle	28.8	8.2

Source: US, 1974b.

Examples

Table 4-4 provides a summary of the mandatory beverage container deposit/refund systems in use around the world. In 1971, British Columbia[1] became the first jurisdiction to implement a mandatory deposit/refund system which served as a model for Oregon's more famous "Bottle Bill"[2], which came into effect in 1972.[3]

There is considerable variation in the coverage and operation of the deposit systems shown in Table 4-4. First, the type of containers covered by the different systems varies greatly; a few systems are restricted to refillable soft drink containers only, most include both refillable and non-refillable soft drink and beer containers, while a few are extended to include liquor, wine and spirit containers. Second, the point to which the container must be returned to is not always the same. Under most systems the containers are returned to the beverage retailer for refund and eventual collection by the bottlers and brewers. However, some jurisdictions, such as Alberta and California, have established a network of collection depots to which the containers must be returned for refund. Third, the deposit value varies greatly amongst jurisdictions. In the U.S.A. a standard deposit irrespective of container size is common while in Canada the deposit usually increases with the container size. Fourth, as described in Section 2-5, some jurisdictions include a handling fee as part of the deposit system in order to recognize the costs the collection system may impose on the retailer or depot operator. Handling fees are fees the bottler or brewer must pay the retailer/depot operator for every container returned for refund. These fees are typically 1-2 cents per container and their cost to the manufacturers are, without doubt, added onto the wholesale price of the beverages.

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[1] Implemented by the *Litter Act*, R.S.B.C., 1979, c.239, Section 2.

[2] O.R.S. 459.820.

[3] See Gudger and Walters (1976) for a description of the impacts of Oregon's deposit system.

TABLE 4-4

A SUMMARY OF MANDATORY BEVERAGE CONTAINER DEPOSIT/REFUND SYSTEMS

Jurisdiction	Container Type	Deposit	Year Introduced
CANADA			
Alberta	Beer, SD, Liquor	5-20¢	1972
British Columbia	Beer, SD	5-30¢	1971
New Brunswick	Refill Beer & SD	10-40¢	1978
Nova Scotia	Refill Beer & SD	10-40¢	1978
Ontario	Refill SD	15-40¢	1985
P.E.I.	SD	17-70¢	1977
Saskatchewan	Beer, SD	5-10¢	1973
U.S.A.			
California	Beer, SD	1¢	1987
Connecticut	Beer, SD	5¢	1980
Delaware	Beer, SD	5¢	1979
Florida	All	5-10¢	1989
Iowa	Beer, SD, Liquor	5¢	1979
Maine	Beer, SD	5¢	1978
Massachusetts	Beer, SD	5¢	1983
Michigan	Beer, SD	5-10¢	1978
New York	Beer, SD	5¢	1983
Oregon	Beer, SD	25¢	1972
Vermont	Beer, SD	5¢	1973
OTHER			
S. Australia	Beer, SD, Liquor	5¢	1977
Sweden	Aluminum Cans	0.50 SEK	1984

Comments

Table 4-5 provides examples of the very high return rate which mandatory beverage container deposit/refund systems can attain. Because of these return rates deposit systems are considered to be the best method for the control of beverage container litter (for a discussion see OECD, 1978, or Stone, 1988). Beverage container deposit systems have also been credited with reducing the quantity of solid wastes generated by an estimated 3-5 percent in New York (New York, 1987), by 4.5-6 percent in Michigan (Porter, 1983), and by 4-5 percent in Oregon (OECD, 1978).

A further benefit of deposit systems is that they typically result in the increased recycling of the materials from which non-refillable containers are made. For example, in 1983, 83 percent of the aluminum beverage cans sold in the U.S.A. in states with deposit systems were recycled while the average for non-deposit states was only 43.5 percent (see Stone, 1988, p. 40). In addition, U.S. states with mandatory deposit systems are credited with producing virtually all of the PET (polyethylene terephthalate) containers recycled in the United States (Curlee, 1987).

Deposits are far more effective as a user charge on beverage container litter than are the general litter taxes discussed in Section 2-6. Litter taxes are imposed on all purchasers of a product generally found in the litter stream while deposits are lost only by those who do not return the product. Thus, the foregone deposits are restricted to a much smaller population than are the litter taxes and this population will more closely approximate the population of all litterers of the product in question. The deposit also provides a financial incentive for others to collect the littered item.

Whether or not a deposit system will lead to increased economic efficiency will depend upon several factors including the cost to industry of running the system, the inconvenience cost to consumers (if any) of returning the containers, the decrease in solid waste disposal costs resulting from the deposit system, and the decline in eye-sore costs of litter. For a more complete description of these considerations see for example, Lee et al. (1988) and Porter (1983).

TABLE 4-5

EXAMPLES OF RETURN RATES ACHIEVED BY BEVERAGE CONTAINER DEPOSIT/REFUND SYSTEMS

Jurisdiction	Return Rate (%)	Years Reported
British Columbia[1]		1982-86
Beer Containers	91-95	
Soft Drink Containers	50-72	
All Containers	80-88	
Alberta[2]		1976-81
Refillable Bottles	88-90	
Soft Drink Cans	45-54	
Wine and Liquor	80-90	
Saskatchewan[3]		1975-81
Soft Drink Containers	83-86	
Beer Containers	86-93	
Oregon[4]		1973
Soft Drink Containers	92	
Beer Containers	90-95	
New York State[5]		1984-86
Cans	82-84	
Glass Bottles	77-80	
Plastic Bottles	33-50	

Source: 1. Stone, 1988, 2. Alberta Department of Environment, 1976-81, 3. Saskatchewan Department of Environment, 1976-82, 4. Peaker, 1975, 5. New York State, 1987.

4.3 AUTOMOBILE DEPOSITS

The collection and disposal of bulky durable goods, such as car hulks and white goods (refrigerators, stoves, freezers, etc.) can be a major problem, particularly in rural areas. The extent to which these items are recovered by private operators for their scrap metal value fluctuates along with the world price of metals. Two countries have turned to mandatory deposits as a solution to their car hulk disposal problem believing in the efficiency and administrative simplicity of deposit systems.

Sweden

Sweden implemented a deposit system for car hulks in 1976.[4] The deposit of Kr. 250 ($69.10) is imposed on all manufactured and imported vehicles under 1,800 kg (Astedt, 1981). The collection of the deposit is coordinated with the existing value-added tax on vehicles. The vehicle owner when he returns the vehicle to an authorised vehicle scrapper receives a "scrapping certificate". The owner, who pays the scrapper a fee for the car's disposal, receives a refund of Kr. 300 ($82.92) when he turns in the scrapping certificate to the vehicle registration authority who then deregister the vehicle. The refund was later raised to Kr. 500. The deposits when collected, are placed into a government controlled "car scrapping fund" which uses the deposits and the interest earned to finance the refunds and to provide subsidies to local governments to recover abandoned car hulks. By March 1978, Kr. 1.78 million had been granted to local authorities to dispose of approximately 20,000 car hulks. It is reported that the administrative costs associated with the deposit system are quite low (Astedt, 1981).

Norway

In 1974, Norway estimated that it had a backlog of approximately 50,000 abandoned vehicles and the annual generation rate was 20,000 vehicles (Thompson, 1981). The success of the Swedish car hulk deposit system prompted Norway to implement a similar system in May 1978. A deposit of Kr. 450 ($106.52) was imposed on all automobiles and vans under 3,500 kilograms. As there is no domestic manufacturing of vehicles in Norway the deposit is collected along with the vehicle's import duties. The deposit was estimated to represent less than 1 percent of the average new vehicle sales price. A refund of Kr. 500 ($118.40) is paid when the vehicle is returned to specified collection points from where they are shipped to central shredding operation. The average disposal cost per car is reported to be Kr. 700 with the net cost, less the deposit value and the scrap metal value, being Kr. 100 per vehicle (OECD, 1980).

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[4] Implemented by the 1975 *Wrecked Automobile Act* (Reese, 1983).

Comments

Both countries have expressed pleasure with their deposit systems and have considered the extension of their use to the collection of household appliances (Astedt, 1981 and Thompson, 1981).

It should be noted that the car hulk problem both countries faced may, at least in part, have been due to a ban each had on the export of scrap metals. The bans may have acted to depress domestic scrap metal prices which would decrease the incentive for private dealers to collect abandoned vehicles.

4.4 BATTERY DEPOSITS

In Section 2.8 the potential environmental problems associated with the improper disposal of auto and household batteries were discussed. Jurisdictions have recently started to turn to deposit systems in order to ensure the proper collection and disposal of both lead-acid and household batteries.

Rhode Island implemented a deposit system on lead-acid batteries in the summer of 1988 (Resource Recycling, 1988).[5] The deposit of $5.00 per battery is refunded when consumers return the spent battery to the retailer for recycling within seven days. Unremitted deposits are held in trust by the retailer until July of each year when the retailer must remit 80% of the revenue in the fund. The retailer retains the remaining 20%.

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[5] Rhode Island R.S. 23-60-1 et seq.

Distributors or manufacturers must accept from retailers batteries returned to them of the size, kind and brand sold by them. The distributers and manufacturers must also pay the retailer a handling fee of at least 20% of the deposit value for each battery returned. Disposal of lead-acid batteries, other than at a licensed recycling facility was also banned.

Maine also established a deposit on lead-acid batteries in 1989.[6] Deposits of $10.00 per battery are collected when a used battery is not exchanged at the time of purchase of the new battery.

Wisconsin will implement a lead-acid battery deposit system on January 1, 1991.[7] A deposit of up to $5 per battery may be charged by retailers. The retailer must refund the deposit when a consumer returns the battery to the retailer.

In addition, as described in Section 2.8, the states of Washington and Minnesota have imposed lead-acid battery taxes which operate in a manner very similar to a deposit system.

Comments

It is reported that several European countries, including Denmark, Finland, and the Netherlands, are considering implementing deposit systems on batteries containing mercury and cadmium (OECD, 1989).

In West Germany the fourth amendments to the *Waste Disposal Act* gives the German federal government the power to impose deposits on products which pose a problem if landfilled (Williams, 1987).

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[6] Title 38 M.R.S. §1604. The deposits collected are held in trust by the retailers.

[7] Wisconsin R.S. Section 159.18.

4.5 CONCLUSIONS

Deposit systems have clearly demonstrated their ability to ensure a high return rate for the products on which a deposit has been imposed. A key element of deposit systems, one that is frequently overlooked, is that there must be a network of return locations which is convenient for consumers to use. Typically, but not always, a return-to-retailer system[8] is employed. Such a system does entail additional costs on the retailer who must store and handle the items returned. These additional costs could be viewed as simply part of the retailer's cost of operation or, alternatively, as added costs requiring recognition by government. In the latter case, a handling charge, as is used by some jurisdictions with their beverage container deposit system, could be used to offset these added costs.

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[8] For example, Alberta, Saskatchewan and California employ a special depot system to handle the return of beverage containers. Sweden and Norway also have special locations for the refund of auto hulk deposits.

SECTION FIVE

PROBLEM PRODUCTS IN THE MUNICIPAL WASTE STREAM

5.1 INTRODUCTION

While the foregoing review of the excise taxes used by other jurisdictions for environmental management provides useful examples and case studies, it does not necessarily follow that these taxes could or should be used in British Columbia. Instead, it is necessary to first identify which products are causing specific disposal or environmental problems and second, to examine if a tax, a deposit, or some other policy instrument would be the appropriate mechanism to solve the specific problem. When a tax is chosen as the policy instrument, the objective of the tax should be clearly identified, ie to serve in lieu of a user charge, to reduce demand, etc. The potential uses of the revenues generated by the tax should also be specified, particularly when the tax is imposed in lieu of a user charge for the disposal of a product.

5.2 IDENTIFYING THE PROBLEM PRODUCTS

Two approaches were used to identify the problem products in the province's municipal solid waste stream. The first approach was to ask municipalities, in a letter from the Minister of Environment, to provide the Ministry with a list of problem products or materials entering their waste streams. The letter was sent to all local governments which currently consists of 175 incorporated municipalities and regional districts. The local governments were also asked to identify:

- the quantity of each problem product or material annually entering their waste stream (eg. 1000 tires, 500 litres of waste oil, etc.);
- the method of disposal currently used for each of the problem products or materials; and
- the approximate additional disposal cost for each of the problem products or materials.

It was realized that it would be difficult for the local governments to answer these questions. However, they were in the best position to provide any immediate answers without further considerable research. In total 35 responses were received from local governments of which five stated that they could not provide any information, leaving 30 useable responses.

A second approach was also used in order to supplement the information gathered from local governments. A briefing memo was sent to the Ministry's seven regional waste managers outlining the questions asked of local governments and asking the regional managers to answer the same questions for their region as a whole. Three regional offices were able to provide partial answers; Vancouver Island, the Lower Mainland and Cariboo Regions.

5.3 RESULTS

Table 5-1 lists the major products identified as presenting special disposal problems by the 33 respondents who provided a usable return. The results presented in the table should be taken as indicative of the problems local governments face but not necessarily as representative of all municipalities due to the low response rate achieved. Most respondents were able to identify the problem products in their waste stream, but few were able to provide estimates of the quantity entering the waste stream, and even fewer were able to estimate the additional disposal costs associated with these products.

The products identified as posing disposal problems were not unexpected. They include vehicle tires, lead-acid (automotive) batteries, other household batteries (dry-cells), waste oils (particularly motor oil) white goods (appliances such as stoves, refrigerators, freezers, etc.) auto hulks, and household hazardous wastes (ie. paints, solvents, cleaners, pesticides, etc.). Other materials were also identified as causing additional disposal problems but were not included in Table 5-1 because they were not a specific product or the consumption of the material was not directly

TABLE 5-1

PROBLEM PRODUCTS IN THE MUNICIPAL WASTE STREAM

Problem Products	Respondents	Quantity Reported		Additional Disposal Costs	
	Number Reporting	Number Reporting	Quantity	Number Reporting	Average Cost
Tires	24	15	630,980	5	$0.31-$5/tire
Lead-acid Batteries	9	3	1,200	1	$1.50/battery
Other Batteries	2	-	-	-	-
Waste Oils	16	5	69,505 litres	2	$0.20/litre
White Goods	14	-	-	-	-
Auto Hulks	13	8	1,480	3	$92-$155/hulk
Household Hazardous Wastes	12	2	20,300 tonnes	1	$2,000-$20,000/tonne

related to the quantity eventually disposed. As such, these materials would not be good candidates for the use of an excise tax. Examples of these materials included yard wastes, animal carcasses, hog fuel, and demolition debris. Gypsum was also reported to be a problem in the lower mainland.

5.4 POTENTIAL TAX MEASURES

The potential use of an excise tax as an environmental management tool is examined for each of the problem products identified above. The potential use of an excise tax is assessed for each product based on the potential objectives of environmental excise taxes, described in Section 1.3, and the practical design criteria discussed in Section 1.4.

A TIRE TAX

The main purpose for a tax on vehicle tires would be to serve in lieu of a user fee to fund the collection and recycling or disposal of waste tires in British Columbia. As noted earlier, tires are bulky, difficult to compact, and tend to float up through landfills after burial. If stockpiled they serve as a breeding ground for insects and can pose a fire hazard.

Eleven jurisdictions, as described in Section 2.3, have imposed excise taxes on tires which, in all cases, were imposed in lieu of a user charge for the disposal of the tires. Nine of the jurisdiction imposed the tax at a flat rate while the remaining two imposed ad valorem taxes. All of the taxes were collected at the retail level. If tire taxes were imposed in British Columbia a flat rate tax would appear to be the more appropriate choice as the disposal costs would be related to the size of the tire and not necessarily its value. However, it would be appropriate to have such a tax differentiated between light duty vehicle tires and large commercial/industrial tires. As with the taxes of other jurisdictions the tax would need to be collected at the retail level.

The Canadian domestic market for tires was 35.2 million tires in 1986. Assuming British Columbia accounts for 10 percent of the Canadian market, then 3.5 million tires were sold in the province. As noted earlier a

1984 study of scrap tires estimated there were at least 2.2 million tires scrapped annually in the province (H.A. Simons Ltd., 1984). The potential revenue which could be generated through a tire tax are detailed in Table 5-2.

TABLE 5-2

POTENTIAL TIRE TAX RATES AND REVENUES

Tax Rate ($/tire)	Revenue* ($ million)	Price Increase** (%)
1.00	2.2-3.5	1
2.00	4.4-7.0	2
3.00	6.6-10.5	3
4.00	8.8-14.0	4
5.00	11.0-17.5	5

* Assumes annual replacement tire sales of 2.2-3.5 million.
** Average price for a passenger vehicle tire assumed to be $100.

A LEAD-ACID BATTERY TAX

The purpose of a lead-acid battery tax would be to fund the collection and recycling or disposal of lead-acid batteries in the province. Lead-acid batteries contain approximately 22 lbs of lead and lead oxide plus a volume of sulphuric acid, both of which are classified as special wastes. Batteries, if disposed of at landfills, can cause ground water and soil contamination, and if incinerated can cause significant air emissions.

Table 5-3 details the Canadian market for lead acid batteries sold for replacement purposes. If British Columbia accounts for 10 percent of the Canadian market then approximately 488,100 replacement lead-acid batteries are sold annually in the province.

TABLE 5-3

CANADIAN MARKET FOR LEAD-ACID BATTERIES

	Number*	Value*
Produce in Canada	3,329,347	$170,333,355
Less Exports	592,786	$25,045,000
Plus Imports	2,144,135	$71,079,000
Total Canadian Market	4,880,695	$216,367,335

Source: Statistics Canada, Cat. 43-005, 65-004, and 65-007.

Four jurisdictions have imposed excise taxes on lead-acid batteries, as described in Section 2.8. All of the taxes used a flat tax rate of $1-$5 per battery. Three other jurisdictions, as described in Section 4.4, have implemented mandatory deposits on batteries, with the deposit ranging from $5-$10 per battery. In all cases the deposits and taxes are collected at the retail level.

Three tax/deposit options for lead-acid batteries are available for British Columbia:

- **Excise tax** - a tax of $5 per battery could generate revenue of approximately $2.44 million and would increase the average cost of a battery by approximately 5 percent.[1] The funds could then be used to operate a provincial battery collection and disposal system.
- **Deposit** - a deposit of $5-10 per battery would ensure the majority of batteries are returned to a retailer for ultimate collection and disposal. However, the province would likely have to administer the central collection of deposits from retailers and the disbursement of

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[1] Assumes the average price of a new lead-acid battery of $100.

refunds back to retailers.

- **Deposit Tax** - a tax of $5-10 per battery payable only if a spent battery is not exchanged at the time of purchase. This option would ensure most batteries are returned to retailers without the necessity of the province running a central deposit/refund fund. If the deposit tax was successful in encouraging the exchange of batteries little provincial revenue would be generated.

Under the first option the tax would serve in lieu of a user charge for the collection and disposal of spent batteries. The latter two options would mainly serve as an incentive for consumers to return the spent batteries for collection. The third option would appear to be the simplest mechanism for ensuring a high return rate of batteries back to retailers for collection and safe disposal or recycling.

A HOUSEHOLD BATTERY TAX

If a tax were used in lieu of a user charge for the collection and disposal of spent household batteries then the tax should logically be based on the relative weight or size of the battery and on its material composition. The collection of such a tax at the retail level presents at least two problems. First, these are a number of different household battery sizes, including A, AA, AAA, B, C, D, and 9V plus a number of smaller batteries for such things as hearing aids, calculators, and cameras. Second, there are a vast number of retail outlets selling household batteries in the province. These two factors could combine to make the administration of the tax unacceptably difficult. The alternatives would be to either use a flat tax regardless of battery size or use an ad valorem tax rate. A better option may be to move the collection of the tax further up the distribution chain, to either the wholesale or manufacture level. However collection at this level may be outside the province's jurisdiction, suggesting that such a tax is more easily implemented by the federal government.

Unfortunately, estimates of the number of household batteries consumed in the province each year are not available so estimates of the potential tax revenue cannot be made.

A LUBRICATING OIL TAX

A tax on lubricating oils could serve in lieu of a user charge to fund the collection and recycling or disposal of waste oils in the province. Waste oil accounts for 35 percent of the province's total amount of special wastes. Table 5-4 lists the domestic sales of lubricating oils and greases in the province.

TABLE 5-4

B.C. DOMESTIC SALES OF LUBRICATING OILS AND GREASES

Year	B.C. Domestic Sales (millions of litres)
1985	87.1
1986	92.9
1987	103.1
1988	112.9

Source: Statistics Canada, Cat. 45-004.

As described in Section 2.4, at least eight jurisdictions have implemented special excise taxes on lubricating oils. In almost all cases the taxes were imposed in lieu of a user charge to fund national waste oil collection and disposal systems. All of the European taxes are collected at the manufacturing level while the U.S. state taxes are collected at the retail level.

Collection of a lubricating oil tax at the retail level in British Columbia, through the *Social Service Tax Act*, could prove to be very difficult to administer due to the large number of retail outlets in the province selling lubricating oils. Retail outlets selling lubricating oil now include service stations, automotive shops, grocery stores and even pharmacies. It would be administratively easier if such a tax were collected further up the distribution chain, at the manufacturer or wholesaler level, and is therefore more easily introduced by the federal government than by the province Table 5-5 outlines the potential revenue a tax on lubricating oils could generate and the potential effect on the retail price of motor oil.

TABLE 5-5

POTENTIAL LUBRICATING OIL TAX REVENUES

Tax (¢/litre)	Revenue* ($ millions)	Price Increase** (%)
1	1.15	0.57
2	2.30	1.14
5	5.75	2.86
10	11.50	5.71

* Assumes annual sales of 115 million litres of lubricating oils and greases.

** Expected retail price increase on motor oil if tax is fully passed on to consumers. Assumes a current average retail price of $1.75 per litre.

A WHITE GOODS TAX

As noted earlier a white good is the industry term used to describe major household appliances such as washers, dryers, refrigerators, freezers, stoves, hot water tanks, etc. These products, due to their bulk, can take up a significant amount of space if disposed of in a landfill. As landfill capacity becomes a scarce commodity, some jurisdictions are starting to examine the use of excise taxes to fund more appropriate disposal methods. So far Maine is the only jurisdiction which has moved to implement such a measure. As described in Section 2.11, it imposed a tax at the retail level on white and brown goods of $15.00 each, effective July 1, 1990. The imposition of a flat rate tax such as Maine's should be relatively easy to administer and enforce. However, because the tax does not differentiate between goods of different sizes the equity of a tax imposed in lieu of a user charge for the disposal of the good is questionable.

If it is deemed desirable to impose a tax in British Columbia on white goods in lieu of a user charge for their disposal then three tax formats are available:

- **Flat Unit Tax** - This option would see a flat tax per white good sold in British Columbia in the same manner as Maine's tax. This tax should be relatively easy to administer and enforce at the retail level but, as noted above, the tax would not vary in accordance with the size of the good which diminishes the ability of the tax to serve in lieu of a user charge.

- **Unit Tax Rate** - Under this option the tax would be based on the size of the white good, either on its volume or weight, for example, a tax rate of $1 per cubic food could be used. This type of tax would be far more appropriate if the tax is to serve in lieu of a user charge for the disposal of the goods as the amount of the tax would be directly related to the quantity of material requiring disposal. However, such a tax would probably be very difficult to administer if collected at the retail level. The tax would be easier to implement if collected at the manufacturing level, however, this may be outside of the province's jurisdiction.

- **Ad Valorem Tax** - A tax based on a percentage of the value of the good could prove to be a useful compromise between the two tax options given above. The tax would probably be as simple to administer at the retail level as would the flat unit tax while at the same time varying, to a degree, with the size of the good. Within each appliance category the value of an appliance will in part be related to the size of the good. However, between appliance categories there will probably be discrepancies in relating the value to the size of the goods. Further work is therefore required in order to see if an ad valorem tax on white goods would produce any unacceptable inequities in its operation. In addition, an ad valorem tax, collected by retailers would fall within the province's taxing power.

A VEHICLE DISPOSAL FEE

It is not known if any other jurisdiction has imposed a vehicle disposal fee to fund the collection and disposal of abandoned auto hulks. However, Sweden and Norway, as described in Section 4.3, have implemented mandatory deposits on car hulks in order to ensure their return to authorized disposal sites.

The purpose of a vehicle disposal fee would be to serve in lieu of a user charge for the collection and disposal of derelict vehicles, including the vehicle's tires and battery, and to possibly fund the recovery of CFCs from automobile air conditioners. Table 5-6 provides examples of potential fee levels, the expected revenue generated for each fee level, and the fee's expected impact on the price of a new vehicle.

A vehicle disposal fee could potentially be imposed in British Columbia at the retail level, in the form of a special sales tax, or collected as part of the vehicle's registration fee. Collection of the fee as part of the vehicle's initial registration in the province should be easier to administer and would allow for the collection of the fee from used vehicles brought into the province.

Alternatively a mandatory deposit system could be employed. Such a system could ensure a high return rate of hulks to collection points if the deposit was set high enough. Potentially, unredeemed deposits could be used to recover any abandoned hulks. However, the province would need to establish a system for monitoring and controlling the authorized redemption points and the disbursement of the refunds.

TABLE 5-6

VEHICLE DISPOSAL FEE RATES AND REVENUES

Fee Level	Revenue*	Price Increase**	
		Passenger Cars	Commercial Vehs
$25	$4,000,000	0.14%	0.12%
$50	$8,000,000	0.28%	0.24%
$100	$16,000,000	0.56%	0.48%

* Assumes annual vehicle sales of 160,000.

** Assumes average price for passenger cars and commercial vehicles of $18,000 and $21,000 respectively.

A HOUSEHOLD HAZARDOUS WASTE TAX

A tax on household products which generate hazardous wastes could potentially be used in lieu of a user charge to pay for the collection and disposal of waste products. However, the number of products which can be classified as a household hazardous waste is very large and includes such things as:

- Pesticides
- Herbicides
- Fertilizers
- Household Cleaners
- Antifreeze
- Motor and Other Lubricating Oils
- Paints and Solvents
- Wood Stains and Preservatives
- Turpentine and Paint Thinners
- Swimming Pool Chemicals
- Camping and BBQ Fuels.

The administration of the tax for government and retailers, would be extremely difficult because of the number of different products and the number of places at which the products are sold.

A second problem with a tax on these products stems from the fact that only the unused portion of the product becomes a hazardous waste. Thus, a consumer who purchases a product which is used completely would not generate any wastes. In this case, it would be inequitable to collect the tax, which was imposed in lieu of a user charge for the disposal of the wastes.

An alternative to a general tax on all household hazardous wastes would be a highly selective tax on particularly toxic products. In this case the tax would not be used in lieu of a user charge but rather as an instrument to reduce the demand for the specific products. The use of this approach first requires that some ranking of products by their relative environmental risk take place and second that some less toxic substitute product be available for consumers to use.

5.5 LITTER CONTROL TAX MEASURES

In August 1988, the Minister of Environment appointed a Task Force to "conduct a review of municipal solid waste management policies in British Columbia" (Municipal Solid Waste Management Task Force, 1989). Included within their broad terms of reference was a review of provincial litter control practices. The Task Force, in its final report, recommended that the province maintain and expand its beverage container refund system as one of its solid waste management instruments. They also recommended that:

- the province introduce a mandatory handling fee of 2 cents per soft drink container payable by soft drink bottlers and importers to retailers, bottle depots, or recyclers for every container returned back through them; and

- the province impose a 2 cent per container tax on "sealed non-rigid" soft drink containers, with the funds generated being directed towards litter control measures.[2]

As described in Section 2.5, handling fees have been implemented to recognize the role of retailers and depot operators in the return of beverage containers. The proposed handling fee would not, of course, generate any revenue for government. However, it could promote the development of recycling centres and bottle depot operations.

The purpose of a tax on sealed non-rigid containers is to serve in lieu of a user charge for litter control as it would not be feasible to return this container type back through a deposit/refund system. The tax was also recommended to ensure that the 2 cent per container handling fee recommended on rigid containers did not create a competitive advantage for non-rigid containers.

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[2] The term "sealed non-rigid" containers covers aseptic packaging such as drink boxes.

SECTION SIX

INDUSTRIAL WASTE CONCERNS IN BRITISH COLUMBIA

6.1 INTRODUCTION

This section has three purposes. First, it attempts to identify industrial waste problems in British Columbia to which environmental excise taxes could be employed as a management tool. Excluded from this review are industrial waste discharges made in accordance with a waste discharge permit issued under the *Waste Management Act*. The application of economic incentives to direct discharges of wastes to the environment would best be handled through the use of waste discharge fees or transferable discharge permits. A review of these latter economic tools is beyond the scope of this paper and the reader is directed to Hahn (1989) or Tietenburg (1985) for a description of their use and capabilities. The second purpose is to examine in more detail the use of excise taxes as a means of addressing the use of packaging materials in consumer and other products. The third purpose is to examine the potential for using excise taxes as a means of funding the environmental monitoring and control costs associated with vehicle exhaust emissions.

6.2 SPECIFIC INDUSTRIAL WASTE PROBLEMS

The industrial waste problems reviewed below includes leaking underground storage tanks, ozone depleting substances, antisapstain chemicals, and CO_2 emissions from fossil fuel combustion.

L.U.S.T.

The potential environmental problems associated with leaking underground storage tanks were described in Section 3.4. In British Columbia the Ministry of Environment estimates that there could be thirty to fifty thousand underground storage tanks currently in use. These tanks vary considerably in size from small household fuel tanks to large industrial tanks with storage capacities of over 50,000 litres. The Ministry is currently in the process of developing regulations to control the installation and operation of underground petroleum storage tanks in accordance with guidelines produced by the Canadian Council of Resource and Environment Ministers (CCREM, 1988). The Ministry also wishes to establish a trust fund to pay for the clean up of abandoned storage tanks where the owner cannot be found or cannot be held financially liable for the clean up costs. The Ministry speculates that there could be several thousand abandoned tanks in the province.

At least two options are available to fund the regulation of underground storage tanks and the clean up of "orphaned" tanks; the imposition of a special excise tax on petroleum products, or the establishment of tank registration fees. In Section 3.5, the U.S. LUST tax of 0.1 cent per gallon of gasoline and other motive fuels was reviewed. These funds are directed to a trust fund to pay for the clean up of orphaned sites. On the other hand, New Brunswick, the Canadian leader in the regulation of underground storage tanks, has chosen to use annual registration fees as its funding mechanism.[1] The annual fees for a storage system with a capacity of 2,000 litres or more (200 litres or more for marinas) are $10 for farms systems, $25 for marinas and commercial/industrial woodland operation systems, $50 for government or institutional systems, $100 for retail outlet systems, and $500 for bulk plant systems.

The establishment of tank registration fees would appear to be the most equitable means of funding the ongoing costs of regulation and inspection of underground storage tanks. However, the fees should vary in accordance with the size of each tank as it is the size of the tank which is directly related to the relative environmental risk posed by each tank. It is not clear, however, that the registration fees on current tank operators, operating in accordance with current regulations, should be used to fully fund the clean up costs of orphaned sites. The use of registration fees in conjunction with a more broadly based financing mechanism, such as a special excise tax on petroleum products, could prove to be a more equitable solution. In any event, an estimate of the number of orphaned sites plus the expected costs of clean up is required before any recommendations can be made on the appropriate funding mechanisms to use for orphaned sites.

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[1] *New Brunswick Regulation 87-97*, issued July 30, 1987, under the *Clean Environment Act*.

Ozone Depleting Substances

British Columbia is in the process of developing regulations for the control of ozone depleting substances (ODS) which would complement the federal government's initiatives in this area. The main thrust of the proposed federal regulations is to eliminate the production of ODS while the proposed provincial regulations would be aimed at eliminating the non-essential uses of ODS and reducing the release of ODS from the current provincial ODS inventory.[2] There are two potential difficulties with the provincial approach. First, a definition of "essential" and "non-essential" uses for ODS is required. Second, the implementation and enforcement of regulations could prove onerous.

An alternative to the direct regulation of the "non-essential" uses of ODS is the imposition of an excise tax on ODS. The tax, by increasing the price for ODS, would encourage consumers to seek alternatives for ODS, thus reducing the demand for ODS. A tax would also eliminate the need for a definition of "essential" uses for ODS as consumers with low cost alternatives for ODS would quickly switch from ODS to these alternatives, assuming the tax was set high enough, while consumers with high cost alternatives would continue, in the short run at least, to use ODS. In this manner the market, through the pricing mechanism, would determine what constitutes an essential or non-essential use. The tax would not, however, eliminate the need for regulations aimed at reducing the release of ODS from the current provincial ODS inventory.

Antisapstain Chemicals

Antisapstain chemicals are used in the treatment of wood products to prevent sapstains, the blue/black surface discolouration caused by molds and fungi. Sapstains reduce the wood's aesthetic appeal and thus its value and market acceptability. Antisapstain chemicals are used in British Columbia to treat an estimated 3.6 billion Mfbm (thousand foot-board measure) of lumber annually, worth more than $2 billion per year in export market value (Anti-sapstain Chemical Leachate/Stormwater Task Force, 1988). The chemicals currently registered for antisapstain use in Canada are:

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[2] This inventory would include the CFCs and Halon in appliances, such as refrigerators, freezers and air conditioners, heat pumps, auto air conditioners, fire extinguishers and store shelf stocks.

- chlorophenates[3];
- 2-(thiocyanomethylthio)benzothiazole (TCMTB);
- copper-8-quinolinolate (Cu-8); and
- Ecobrite (composed of borax and sodium carbonate).

Unfortunately, most of these chemicals are acutely toxic to fish. For example, the 96 hour LC_{50} for sensitive salmonoid species is 30-100 parts per billion (ppb) for chlorophenates, 15-60 ppb for TCMTB, and 15-24 ppb for Cu-8 (Anti-sapstain Chemical Leachate/Stormwater Task Force, 1988). In addition, chlorophenates bio-accumulate in marine organisms, are persistent in the environment, and contain traces of chlorinated dioxins and furans. There is far less concern over the use of Ecobrite.

A 1987 report of chlorophenates in storm water drainage from sawmills along the Fraser River showed concentrations of 500-6600 ppb which are many times the toxic levels given above (Krahn et al., 1987). Concerns about antisapstain discharges led to the development of provincial regulations under the *Waste Management Act* in an attempt to minimize these discharges.[4]

An excise tax on antisapstain chemicals could possibly be used as an alternative to, or in tandem with, direct regulation. A tax on highly toxic antisapstain chemicals could induce industry to switch to less toxic alternatives. The use of this approach has two requirements. First, government should move quickly to register less toxic alternatives for use in Canada. Second, government may require an estimate of the cost differential, if any, between highly toxic and less toxic anti-sapstain alternatives.

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[3] Chlorophenates include the water soluble sodium salts of tetrachlorophenol and pentachlorophenol.

[4] *Antisapstain Chemical Waste Control Regulation*, B.C. Reg. 258/89.

Carbon Taxes

The potential consequences of global warming, caused by the increased concentration of carbon dioxide (CO_2) and other greenhouse gases in the atmosphere, have prompted some governments to consider the use of "carbon taxes" as a method to reduce CO_2 emissions caused by the combustion of fossil fuels. For example, the Swedish Commission on Economic Instruments in Environmental Policy recommended the imposition of a tax of 3.8 cents per kilogram of CO_2 emitted by oil, natural gas or coal (International Environment Reporter, 1989). The Netherlands has already imposed a similar tax (see Section 3.5). By basing the tax on the quantity of CO_2 emitted the tax creates an incentive both to reduce the use of fossil fuels and to switch to fuels which emit less CO_2.

A carbon tax should ideally apply to all fuels with the tax rate for each fuel type based on the relative amount of CO_2 produced during combustion. Where fuel products are used as a chemical feedstock rather than as a fuel source the product should be exempted from the tax. The revenues generated by such a tax could potentially be used to support energy conservation programs, such as increased insulation, or to assist energy users with the capital costs associated with switching fuels.

There are several problems associated with introducing a carbon tax in British Columbia.

First, the province already has motor fuel taxes and oil royalties which significantly contribute to general revenues and are used to fund such essential services as road maintenance and health care. Adding a carbon tax could raise the price of gasoline significantly causing leakage into the United States and Alberta, as provincial residents cross borders to buy cheaper motor fuel. In the Greater Vancouver Regional District, the transit tax adds a further three cents per litre on purchases of motor fuel.

Second, a carbon tax will affect the price of home heating fuel, which is currently exempt of provincial tax. Higher oil and natural gas prices may encourage residents to convert to electric heating, even though hydroelectric power has environmental problems associated with it as well.

Third, it is administratively simpler for the federal government to introduce a carbon tax, as it could be imposed at the manufacturer's level. A federal carbon tax would also require that all users within Canada be subject to the tax, and thus eliminate tax avoidance between Canadian jurisdictions.

6.3 PACKAGING MATERIAL TAXES

A tax on packaging material could potentially be used either in lieu of a user charge for the disposal of the packaging materials after use, or as an economic incentive to industries to minimize their use of packaging materials. In fact a well designed tax could achieve both results. Several packaging tax initiatives were reviewed earlier. Section 2.10 reviewed Italy's tax on non-biodegradable plastic shopping bags and Florida's "advanced disposal fee" on containers. In addition, Section 2.6 provided a review of three U.S. state taxes on litterable products. As litter mainly stems from a product's packaging material these taxes are applicable to the discussion here.

Italy's bag tax was imposed to reduce the demand for plastic bag use and to promote the use of biodegradable alternatives. Florida's container taxes and the litterable product taxes are meant to serve in lieu of a user charge for the disposal costs of these items. Florida's tax comes into force in 1992 on containers whose material content have not achieved a 50 percent recycling rate, thus, the tax does provide some incentive to ensure materials are being sufficiently recycled.

Italy's and Florida's taxes are unit taxes, 100 lira per bag and 1 cent per container respectively, while all of the litter taxes are imposed as an ad valorem rate on the products' selling price. Unit taxes which differ by the amount and type of packaging material used would appear to be the most appropriate when the tax is used in lieu of a user charge. However, the administration of such taxes, especially when collected at the retail level, as will be the case with Florida's container tax, may prove to be a nightmare. Ad valorem taxes, while far easier to administer, could be viewed as highly inequitable as the value of a product is not likely to be proportional to the quantity of packaging material used, nor is it capable of differentiating between packaging material types, which may be an important consideration.

A far better approach to packaging material taxes is the product charge proposal put forward by the U.S. Environmental Protection Agency (U.S., 1977). The EPA's proposal would have had the packaging material tax imposed at the packaging material manufacturing stage in order to minimize the administrative difficulties. Materials which would have been covered by the tax are shown in Table 6-1. The tax proposal based the total tax on the weight of the material used which would have been taxed at the rate of $26 per ton, which was approximately the average cost of solid waste disposal in the U.S. at that time.[5] The EPA proposal contained a tax credit for packaging materials using recycled material so only "virgin" material would be taxed.[6]

The imposition of a packaging material tax similar to the EPA's proposal would probably be outside of the province's jurisdiction. However, the federal government could potentially impose such a tax on behalf of the provinces and distribute the revenues generated on a per capita or other basis. Such a tax should ideally have the following characteristics:

- The tax should be collected at the point in the manufacturing chain where the material is transformed into a package. This would provide the packaging manufacturer with the incentive to minimize the material used and to select materials with the lowest tax rate.
- The tax should be able to differentiate between the type of packaging materials used. This would allow the tax rate to be set in accordance with environmental costs associated with each material type.
- The tax should apply only to virgin materials. The exemption of recycled material should increase the demand for recycled materials

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[5] The proposal made an exception for rigid containers which due to their bulk were considered inappropriate to tax on the basis of their weight. Instead the proposal called for a tax of 0.5 cent per container.

[6] To qualify the recycled material would have to have been "post-consumer" material rather than industrial scrap.

TABLE 6-1

U.S. EPA PACKAGING TAX PROPOSAL

Packaging Materials Included	U.S. SIC*
Converting Paper	26412,26415
Bag Paper	2431
Glassine	2643
Boxboard	2651,2652,2654,2655
Paper Closures	26451/81
Cellophane	2821
Polyethylene	2821
Polypropylene	2821
Plastic Sheet	2821
Polystyrene and other Thermoformed	2821
Plastic Closures	30794/71
Plastic Bottles	3079
Plastic Tubes, Cups, Jars, Boxes, Baskets, Foams	3079
Glass Jars	3221
Glass Refillable Bottles	3221
Glass Non-refillable Bottles	3221
Steel Cans	3411
Aerosol Cans	3411
Metal Closures	34616,24617
Aluminum Foil	3352
Aluminum Plates	3352
Aluminum Cans	3411
Collapsible Tubes	3496

*SIC - standard industrial classification.

Source: U.S., 1977.

and provide an incentive for manufacturers to see that their materials are being recycled.
- The tax should only apply to products sold within Canada in order to ensure Canadian goods remain competitive on international markets and a mechanism to collect the tax on the packaging materials of imported goods would also be required.

In addition, it may be desirable for a packaging tax to differentiate between materials with special characteristics, for example, biodegradability, in order to encourage or discourage the use of materials with that characteristic.

The calculation of a packaging material tax with the properties described above could be done in the following manner:

$$TT = \sum_{i=1}^{n} Q_i \times T_i \times (1 - R_i) \times C_i$$

where:
TT = the firm's total tax on packaging materials;
Q_i = the quantity of packaging material type i used, based either on the material's volume or weight;
T_i = the tax rate per unit of packaging material used;
R_i = the percentage of recycled material contained in packaging material i, or alternatively the recycling rate achieved by that container type by that industry;
C_i = an adjustment factor for material with a specific characteristic. For example, if biodegradability is a desired characteristic then $C_i=0.5$ if it is degradable within a certain time period, otherwise $C_i=1.0$; and
n = total number of material types.

If such a tax mechanism were employed, packaging manufacturers would thus have the following four means of reducing their tax burden:

- minimize the quantity of material used (Q_i);
- select the material with the lowest tax rate (T_i);

- increase the recycled content, or recycling rate, of the packaging material chosen (R_i); and
- select materials with the desired characteristics (C_i).

Table 6-2 presents the value of containers and packaging materials used by Canadian manufacturing industries during 1986 (the latest year available). A total of $5.4 billion of materials was used, however some of this material was exported while a further quantity was imported. Thus the data in Table 6-2 are only indicative of the vast quantity of packaging materials consumed within this country. Further research on the quantity of packaging material consumed in this country plus estimates of the costs of disposing of each material type are required before revenue estimates or estimates of the potential impact on industries and consumers can be made.

TABLE 6-2

CONTAINER AND PACKAGING MATERIAL CONSUMPTION BY CANADIAN MANUFACTURING INDUSTRIES, 1986

Material Used	Value ($ millions)
Corrugated Boxes	997
Metal Cans	911
Folding and Set-up Boxes	674
Glass Bottles, Jars & Carboys	435
Other	2,381
Total	**5,398**

Source: Statistics Canada, Catalogue 31-212.

6.4 VEHICLE EMISSIONS

Motor vehicles are one of the major sources of air pollution in both the country and the province. Table 6-3 shows part of the results of an inventory of common air contaminant emissions for 1980, conducted by Environment Canada (Canada, 1986). The table shows that for three pollutants, carbon monoxide (CO), hydrocarbons (VOC), and nitrogen oxides (NO_x), vehicle emissions are the major source of emissions.[7] This situation worsens when you move from the national and provincial level down to our major urban centres. For example, Table 6-4 shows the estimated contribution by motor vehicles to air emissions in the Greater Vancouver Regional District (GVRD). For all pollutant types the contribution of air emissions by motor vehicles in the GVRD is much higher than was the contribution at either the national and provincial levels.

The first response of governments to the problem of vehicle emissions was the setting of new vehicle emission standards. Canada first brought in emission standards in 1971, which became effective with 1975 model year light duty vehicles.[8] More stringent requirements were brought into force for the 1988 and later model year light duty vehicles. The federal standards are summarized in Table 6-5. The 1988 emission standard brings Canada's standards into line with the U.S. federal standards in place since 1981. Recently Canada has been considering the adoption of California's tougher vehicle emission standards.

While new vehicle emission standards have greatly reduced the quantity of pollutants which otherwise would have been produced they have not solved the air pollution problems. While each new vehicle emits less pollutants there are an increasing number of vehicles on the road each year. In addition, the emission standards do not ensure that the vehicles will be properly maintained in order to ensure that the vehicle continue to

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[7] VOC - volatile organic compounds.

[8] The vehicle emission standards are contained in the *Motor Vehicle Safety Regulations*, C.R.C. 1978, c. 1038, under the *Motor Vehicle Safety Act*, R.S.C. 1985, c. M-10.

TABLE 6-3

VEHICLE EMISSIONS IN CANADA AND BRITISH COLUMBIA, 1980*

Pollutant Type	Vehicle Emisions in Canada (tonnes)	Percent of Total Air Emissions	Vehicle Emissions in British Columbia (tonnes)	Percent of Total Air Emissions
CO	6,584,079	64.0	861,309	45.7
VOC	662,513	35.4	84,840	33.2
NO_x	865,103	50.1	131,907	66.5
SO_x	63,207	1.4	9,705	5.8
Particulate Matter	78,454	4.1	11,183	2.7

* Gasoline and diesel powered motor vehicle engine emissions, excludes emissions from tire wear.

Source: Canada, 1986.

TABLE 6-4

VEHICLE EMISSIONS IN THE GVRD, 1985*

Pollutant Type	Emissions (tonnes)	Percent of GVRD's Total Air Emissions
CO	308,371	89.5
VOC	41,514	53.3
NO_x	32,227	64.2
SO_x	2,077	17.0
Particulate Matter	98,785	81.6
TOTAL	482,974	79.7

* Includes heavy and light duty vehicles.

Source: Greater Vancouver Regional District, 1988.

TABLE 6-5

CANADIAN EMISSION STANDARDS FOR NEW LIGHT DUTY VEHICLES

Emission Standards	1975-1987 Model Years (grams/km)	1988 and Later Model Years (grams/km)
Cars		
Hydrocarbons	1.24	0.25
Carbon Monoxide	15.50	2.11
Nitrogen Oxides	1.92	0.62
Evaporative Emissions*	24.00	2.00
Diesel Particulate	-	0.12
Light Trucks		
Hydrocarbons	1.24	0.50
Carbon Monoxide	15.50	6.21
Nitrogen Oxides	1.92	1.43
Evaporative Emissions*	24.00	2.00
Diesel Particulate	-	0.16

* grams per test.

meet the standards over its service life. To counter the maintenance problem, many areas of the U.S., which do not meet their federal government's air quality objectives, have had to introduce vehicle inspection and maintenance programs which annually or bi-annually inspect each vehicle in order to ensure that it is meeting vehicle emission standards and requires owners to repair any defects. Such an inspection program is under consideration for the Lower Mainland area of British Columbia (Lower Mainland Oxidants Steering Committee, 1989).

Tax Options

Some economists have suggested that as an alternative to vehicle emission standards and inspection programs, governments could use a variable fuel tax. Such a tax would vary in proportion to each vehicle's emission levels, thus the more pollutants a vehicle emitted the more the driver would pay for his fuel. Ideally the variable tax rate would be set to reflect the marginal damage associated with vehicle emissions. By forcing drivers to internalize the external costs of their vehicles emissions the driver would attempt to minimize emissions by selecting vehicles with lower emission levels, by ensuring the proper maintenance of the vehicle in order to reduce the vehicle's emissions, or by reducing the amount of travel in his vehicle.

While the variable fuel tax has, from a theoretical economic view point, much to offer it also has several drawbacks when it comes to its potential implementation. First, the tax would require that each vehicle be tested at regular intervals in order to maintain the appropriate tax rate for each vehicle. Second, government would have to design a means of identifying the tax rate for each vehicle, perhaps by some mandatory vehicle sticker with a bar code. Third, service stations would have to calculate the appropriate tax for each individual vehicle at the time of fuel purchase. Fourth, government would have to effectively enforce the maintenance of each vehicle's tax sticker and the collection of the tax at the thousands of retail fuel outlets in the province. In summary, while the variable tax concept offers a theoretically appealing solution to the problem of vehicle emissions, the administration requirements of such a tax may be too great in relation to the benefits the tax could achieve.

A second tax alternative is to impose a tax on the sale of a vehicle which varied in accordance with the vehicle's rated emission level. This approach is similar to the "gas guzzler" taxes on automobiles described in Section 2.7. By increasing the price of vehicles which emit more pollutants consumers would choose alternative vehicles with lower emission ratings and thus a lower price. However, after the consumer had purchased the vehicle there would be no incentive to maintain the vehicle's low emission levels. However, such a tax should be relatively easy to administer and enforce.

A third tax alternative is to impose a tax in lieu of a user charge, in order to offset the costs to government of air pollution monitoring and control which are attributable to vehicle emissions. For example, the federal, provincial, and some local governments operate a nation wide air quality monitoring system. Some of the costs of this system are borne by point source dischargers as part of their discharge permit requirements. However, much of the cost is paid by general government revenue instead of by polluters. To fund the share of air pollution monitoring and control costs attributable to vehicle emissions, government could either impose a small increase in the motor fuel tax rate, or impose an environmental surcharge on vehicle annual licence fees. Both options should be simple to administer and enforce.[9] An advantage for the first option, increasing the motor fuel tax rate, is that fuel consumption would in part be related to a vehicle's total air emissions. The annual licence fee environmental surcharge could be improved by varying the surcharge in accordance with the vehicle's weight. As the weight of a vehicle increases the air emission rate would also typically increase.

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[9] The motor fuel tax rate could be increased under amendments to the *Motor Fuel Tax Act*. The vehicle licence fee environmental surcharge could be implemented under amendments to the *Motor Vehicle Fees Regulation*, B.C. Reg/ 483/83, under the *Motor Vehicle Act*, and the *Commercial Transport Fees Regulation*, B.C. Reg. 353/84, under the *Commercial Transport Act*.

SECTION SEVEN

BRITISH COLUMBIA ADDENDUM

7.1 Introduction

In the 1990 budget, the Honourable Mel Couvelier, Minister of Finance and Corporate Relations, announced that new environmental levies would be applied to specified consumer products and industrial hazardous products effective July 1, 1990. Revenues from these levies are to be credited to the newly created Sustainable Environment Fund and used to finance waste management initiatives.

The environmental levies were introduced as part of the Province's overall Polluter Pays Policy which will seek to provide funding for environmental management programs from those responsible for creating the environmental problems. Other elements of the Polluter Pays Policy include the modification of the current waste discharge permit fee system, which will be revised on January 1, 1991, to base the fees on the quantity and relative toxicity of the wastes authorized to be discharged, plus the recent increases in environmental fines which can now seek to recover any profits made by polluters as a result of their pollution.

7.2 Consumer Product Environmental Levies

The 1990 provincial budget announced three tax measures which aimed to create incentives "for consumers to decrease their use of environmentally damaging products" (British Columbia, 1990). They were:

- Disposable Diapers - Effective April 20, 1990, the social service tax exemption for children's clothing was removed from disposable diapers for infants. Disposable diapers thus became subject to the 6% general sales tax.

- Tires - Effective July 1, 1990, a tire disposal levy of $3.00 per new pneumatic vehicle tire was imposed. The levy does not apply to:

    - bicycle or wheelchair tires;
    - recapped, retreated or used tires;

  - tires purchased for three wheeled motorized devices designed for transporting handicapped persons;
  - tires specifically designed for use on devices that do not qualify as vehicles, such as lawnmowers, wheelbarrows, and aircraft; and
  - tires with a retail value of less than $30.00 each.

- Lead-acid Batteries - Effective July 1, 1990, a battery disposal levy of $5.00 per new lead-acid battery weighing 2 kilograms or more was imposed. The levy exempts lead-acid batteries used in electric wheelchairs or three wheeled motorized devices designed for transporting handicapped persons, and rebuilt or reconditioned batteries.

Revenues derived from the levies are credited to the Sustainable Environment Fund. The revenue will be used to finance new solid waste recycling and disposal programs, which will target, in particular, disposable diapers, lead-acid batteries and tires. The levies on tires and batteries were imposed in lieu of a user charge for the disposal of these items, while the primary purpose of the removal of the sales tax exemption for disposable diapers was to reduce the demand for disposable diapers.

7.3 Hazardous Product Environmental Levies

Amendments to the *Social Service Tax Act* incorporated in the *Sustainable Environment Fund Act* included the power to introduce a regulation requiring industrial purchasers of specified hazardous products to pay an environmental levy. The regulation would:

- Set the rate of the levy for each hazardous product, with a maximum limit of $20.00 per tonne except for ozone depleting substances.

- Define the methods and formulas to be used to convert a quantity of any hazardous product into tonnes for the purposes of calculating the levy when required.

- Provide exemptions from the levy which may include:

  - one or more classes of persons using the hazardous products;
  - certain uses of the hazardous products; and
  - hazardous products produced under prescribed methods or as by-products of prescribed processes.

- Prescribe the form and manner which define when a product is being sold for household use which would then be exempt from any levy.

The environmental levies on hazardous products were to be introduced by the Province to achieve one or more of the following goals:

- To reduce the demand for hazardous products by providing an economic incentive which will encourage industries to:

  - substitute less harmful products for the hazardous products currently used;
  - adopt production processes which require less of the hazardous products; and
  - recover and recycle hazardous products wherever possible.

- To ensure that the price of a hazardous product reflects not only its production costs but also its environmental costs.

- To serve in lieu of a user charge for the collection and environmentally safe disposal of the hazardous products after their use.

On August 3, 1990, the Province released, for public review, a draft Hazardous Products Levy Regulation. The regulation had originally been scheduled to go into effect on July 1, 1990. However, the implementation date was postponed to September 1, 1990, in order to provide an opportunity for interested parties to comment on the technical details of the levies. This discussion period was needed because of the scarcity of data on chemical consumption within the province. This meant that there was a high probability that some of the measures contained in the draft regulation would have unforeseen and unintended impacts.

Subsequent to the receipt of considerable industry comments, implementation of the draft regulation was cancelled. This decision was taken because it was felt that the hazardous product levies would be too administratively difficult to collect and that a more effective economic instrument to encourage industries to reduce their waste discharges would be through an increase in the provincial waste discharge permit fee system. The new provincial waste discharge fee system is scheduled to be in place early in 1991.

7.4 THE SUSTAINABLE ENVIRONMENT FUND

The Sustainable Environment Fund was established by the province to provide a dedicated source of funding for environmental initiatives and the renewal of provincial forests (British Columbia, 1990). Specifically, the fund will receive revenue from:

- the environmental levies described above;
- waste discharge permit fees[1];
- revenue from environmental prosecutions;
- transfers from the provincial Lottery Fund; and
- contributions to the fund from the federal-provincial Forest Resources Development Agreement.

Table 7-1 lists the revenue that was expected to be raised by the environmental levies during fiscal year 1990/91 and 1991/92.

During 1990/91, the fund would be used to provide $27.3 million for the following waste management initiatives:

- Solid Waste Management Strategy - the first year of a multi-year plan that has a goal of reducing the province's municipal solid waste stream by 50% by the year 2000;

- Hazardous Waste Management Strategy - the establishment of a provincial Crown corporation to develop and implement a strategy for the disposal of hazardous wastes in the Province;

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[1] The waste discharge permit fees were imposed by the Waste Management Permit Fee Regulation B.C. Reg. 304/87, under the Waste Management Act, S.B.C. 1982, c. 41.

- Vehicle Inspection Maintenance Program - the implementation of a vehicle emission inspection program in the Lower Mainland as part of an air pollution control strategy;

- Innovative Waste Management Program - providing financial assistance for new technologies and processes for collecting, treating and disposing of municipal liquid and solid wastes; and

- Other Initiatives - including energy conservation, agriculture soil and water protection programs, and funding to ensure trained prosecutors are available to address the growing number of cases of environmental infractions.

TABLE 7-1

EXPECTED REVENUE FROM THE ENVIRONMENTAL LEVIES

Levy	Revenue	
	1990/91	1991/92
	($ millions)	
Disposable Diapers	2.0	2.0
Vehicle Tires	7.5	10.0
Lead-acid Batteries	2.3	3.0
Hazardous Products*	3.8	5.0
Total	15.6	20.0

Source: British Columbia, 1990, Appendix I.

* Implementation cancelled September 25, 1990.

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